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THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY.

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☞ An asterisk (*) denotes an illustrated article

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WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

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NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

BOSTON, Jan. 1, 1877.

The Annual Meeting of the Association will be held at the Tremont House, Boston, on Wednesday, February 21, 1877, at 10 o'clock, A. M.

GEO. B. NEAL,
Secretary.

LONDON TREATISE ON THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

We are informed that the above work will be complete in *about* 24 numbers, and extend through about two years. No one in the business should be without it. To those who have not ordered it we would suggest that they send, at once, names and address. The first two numbers will be forwarded shortly to those who ordered them early. To others the back numbers will be sent and the work will come regularly every month. Price 40 cents a number. Bills will be sent in due time.

SOCIETE TECHNIQUE DE L'INDUSTRIE DU GAZ EN FRANCE.

This Society, which corresponds to our "Gas-Light Associations," has just issued its third annual report, and it is a very valuable and interesting work, for which we would acknowledge our obligations to Mr. Bremond, the Secretary of the Society.

The papers and discussions together with the plates published with them, show careful preparation and study, and would indicate that the members are thoroughly awake to the necessities of their business. There are about 125 members most of whom are managers of works. Each year there are two prizes, one of 500 francs, and one of 250 francs, given for the best papers upon subjects announced beforehand. This is a practice very much in vogue in France and Germany, and it might be worth while to consider the feasibility of something of the kind in this country.

One disadvantage that we labor under in our country is that our people care very little for "empty honors," as they are called. We are a money-making people, and, although we spend our money freely, when we get it, still, as a general rule, we care too little for the real distinction resulting from high acquirement; and this is particularly true where that distinction "does not pay," as the term is, which means does not bring money.

It would seem that in the business of gas-making there was a field for making a high reputation, for scientific acquirement and practice, second to no other business in the land; and, if we are not mistaken, those who fail to possess themselves of this scientific knowledge and practice, whether they have a reputation for it or not, will before many years find themselves so far outstripped by others that their functions in the business will cease, and their occupations will be gone.

There must be much closer working, both in the retort house and the general office, than there has been in years past, to enable those managing the gas interest to lead and mold public opinion, to satisfy reasonable people that a good article is furnished at a reasonable price, and to make that price one that will be reasonable to the consumer and givr a fair profit to the manufacturer. It is for this very purpose that societies and associations are formed, both in this country and in Europe, and the sooner we bring the standard of our societies up to the highest possible point attainable, the sooner will reasonable people cease to howl, and decry the gas business as one of nothing but fraud. Once satisfy the public that the business is conducted on a strictly scientific basis, and let all those engaged in it establish a reputation, not for acquiring dollars and cents, but for high scientific integrity and ability, and then the 80 millions of capital invested in it in this country may exert an influence for good that cannot fail to make itself heard and respected by all.

PRINCIPLE OF THE VALUATION OF GAS COALS AND CANNELS.

By D. GRAHAM.

Through the courtesy of Mr. Graham, the author, we are in receipt of a copy of the above work. It was published in England a little over a year ago, and has been very favorably received by some of our English brethren. It is a work which shows how exactly the results to be obtained may be foretold by careful investigation and calculation.

The more ready sale for residual products on the other side makes it much more important for them to take these into account, when determining the value of a coal or cannel, than it is for our gas makers. But we hope the time will some day arrive when our residuals will be a source of pro-

fit, and when the question will not be how to get rid of our tar and liquor, but how to utilize our "waste" products so as to be able to produce the most revenue from them. Mr. Graham's method of deducing the value of coals for gas purposes is similar to that of Mr. Farmer, to which reference has been often made in these columns. The latter having been arrived at by a long series of experiments made previous to 1867. In a paper read before the American Association for the Advancement of Science, in 1869, by Professor Silliman, this method, of mixture determined by the rule of allegation, was fully explained, and the credit of its introduction given to Mr. Farmer as its discoverer; and it had been in practical use by him for some time previous to that.

An account, still more definite, of this theory, and confirmed by still further practice, was published in this Journal, on Dec. 16, 1870; and, during the past year, the name "candle feet" was given to the product obtained by multiplying the yield per foot by the candle power. This name was a new one, but the operation of working out the values as described has been practised for about ten years. This subject cannot be too carefull studied, and we trust that our readers who take a real interest in the progress of the science of gas making will try the method faithfully, and we are confident that it will be found correct and reliable if the right data are obtained to start with.

We would speak for Mr. Graham's book a large sale, as he is the first in England to develop the same idea, and has treated the whole subject in a most thorough manner.

Protest of the Canadian Gas Companies against the Stringency of their Gas Act.

Last year a few representatives of Canadian gas companies met Mr. Brunel, Commissioner of Inland Revenue, at Ottawa, to protest against the very stringent conditions of the sales-of-gas Act, as regards sulphur other than sulphuretted hydrogen, and against the exorbitant fees fixed for officially testing gas meters.

After a most careful hearing the Commissioner requested that the views of the deputation be reduced to writing, and presented to him for further consideration. The following is the text of the protest submitted, and will be found of considerable interest to our readers as regards the sulphur bugbear. The authorities quoted are certainly of high standing and should carry conviction—

To A. Brunel, Esq., Commissioner Inland Revenue Department, Ottawa.

Dear Sir: When certain of the undersigned, as a deputation representing the gas companies of the Dominion, had the pleasure of waiting on you at Ottawa recently, to urge the abrogation, or, at any rate, the relaxation of the exceedingly stringent orders, in council of 12th February last, in respect of the amount of sulphur other than sulphuretted hydrogen, and ammonia, permissible in the gas to be supplied hereafter in the Dominion, and also to protest against the exorbitant scale of fees fixed for officially testing gas meters; while receiving the deputation very courteously, and patiently hearing all the objections made, you asked that the objections might be put in writing. We, therefore, hereby beg to comply with your request.

Sulphur.—We respectfully submit that the sulphur remaining in gas freed from sulphuretted hydrogen, while very difficult and expensive to remove, is so infinitesimal as to be without any perceptibly injurious effects, and that its presence is indeed so innocuous as never to be objected to, or even suspected, by the consumer. Dr. Versmann has shown that three lucifer matches burnt in the course of an evening produces as much sulphurous acid as the whole evening's consumption of gas in a room. Dr. Odling, Fullerian Professor of Chemistry at the Royal Institution, London, in a lecture delivered in June, 1868, shows conclusively of how little account this sulphur bugbear is. He said—

"I am altogether at issue with the public when they maintain that the sulphur of gas produces by its combustion oil of vitriol, or that the amount of sulphur ordinarily contained in gas is of any consequence whatever, and a little consideration will, I think, satisfy you of the soundness of this position. We will assume that coal gas contains not 20 but 40 grains of sulphur in 100 cubic feet, a quantity at any rate greatly exceeding the reality. Now, making another extravagant assumption, viz., that the whole of these 40 grains of sulphur would be completely burnt—and in reality they would be burnt very incompletely—they would furnish by their combustion 80 grains of sulphuretted acid gas. This quantity of the produced sulphurous acid would occupy, at ordinary temperatures, about one-fifteenth of a cubic foot; and, since 100 cubic feet of our coal gas gives one-fifteenth of a cubic foot of sulphurous acid, 1500 cubic feet of coal gas would be required to furnish one cubic foot of the acid, even upon the extravagant assumption we have purposely made. But the combustion of 1500 feet of coal gas would produce something besides sulphurous acid. It would produce at least 1000 cubic feet of carbonic acid, and in addition to its dilution with other gases and vapors, we should have our sulphurous acid diluted by 1,000 times its volume of carbonic acid. Now, if we get at the proportion of carbonic acid in the atmosphere of a room highly illuminated with gas, and take the thousandth part of that proportion we shall be able to form some notion of the amount of sulphurous acid present. You will remember that the amount of carbonic acid furnished by the breath of one individual is equal to that furnished by two three feet gas burners, and that the maximum amount of carbonic acid found in the atmosphere of a crowded theatre was 0·32 per cent.

Now if, in addition to our previous unreasonable supposition, we further suppose that an atmosphere contains 0·2 per cent. of carbonic acid furnished by gas combustion, you will see that the whole matter becomes *a reductio ad absurdum*, that we might actually have one half-millionth part of sulphurous acid present in the air of a gas-lighted room."

Dr. Schilling also says in his *Journal fur Gasbeleuchtung*, for 1869. "Twenty grains of sulphur in 100 cubic feet of gas, are entirely unobjectionable. Under the most favorable circumstances with *no ventilation whatever*, it would give the atmosphere of a room only one part of sulphurous acid in 500,000 parts of air."

It will be thus seen that even as a chemical fact, any supposed injurious effects of the presence of sulphur in the gas wholly vanish. In England, where the necessary skill and the requisite appliances are readily obtainable, the sulphur compounds, other than sulphuretted hydrogen, are entirely disregarded outside of London and two or three other large cities. We, therefore, submit that restricting the sulphur to the limits imposed in London, where with all their advantages, keeping it within such limits has been the exception rather than the rule, in a country like Canada, subject to such extreme variations of climate is vexatious and unnecessary, and we hope the Orders in Council, in respect thereto, will be wholly reversed or largely modified.

Ammonia.—If, as has been shown, stringent regulations in respect of sulphur in the gas, are uncalled-for, they are as surely equally so in the case of ammonia. A small quantity of ammonia in the gas is of itself not only unobjectionable, but is rather an advantage in the combustion of gas in combining as an alkali with the aforesaid sulphur compounds, and so neutralizing their supposed injurious effects, by the probable formation of a trace of the harmless product sulphate of ammonia. Like sulphur, it is disregarded in English gas legislation, except in London and a few other places. In such of the States of America where restrictions are imposed, we understand the limit to be 5 grains in 100 cubic feet of gas, and we respectfully suggest that a like proportion be the minimum in Canada.

Fees for Testing Meters.—Notwithstanding your replies to the serious objections urged on this question, by members of the deputation at the interview with you, it is still hoped that you will be able to see your way to a reconsideration, and the recommendation of a considerable reduction in the published scale. The excess over the official prices charged i England, in the usual sized meters, is more than 300 per cent. The exorbitant charges will be a very serious and constant tax on gas companies. In the case, for instance, of the New City Gas Company, of Montreal, it will, including labor in unfixing and refixing meters, amount to at least $2,000 per annum and proportionately so with other companies. It is, therefore, hoped that such alterations will be made in the proposed arrangements as will effect a considerable reduction in this serious outlay.

We are, Sir, yours obediently.

[Signed by the representatives of the several Canadian gas companies.]

On Anthracene Production.

By Dr. Fred. Versmann.

My investigation on anthracene testing, published in the last three numbers of the *Chemical News*, has brought me many inquires and communications, which induce me to supplement this purely scientific investigation and its practical application by some remarks on the commercial aspect of anthracene manufacture generally; and I do so simply because I think my information may enable me, perhaps, to throw some light upon this important question, and also because a crisis in this manufacture seems to become inevitable, and that in no distant time, the serious consequences of which it may well be worth while to weigh and to consider beforehand.

We all recollect the profound sensation created by the grand discovery of artificial alizarine and its manufacture on the large scale, which last commenced only five or six years ago. In recalling the sanguine expectations raised by this new industry, its present dismal position appears scarcely credible, and yet the fact stands out only too clearly that no other branch of chemical industry, inaugurated under such bright auspices, has in its results fallen so short of just expectations—nay, I might also say, has become so disastrous to nearly all persons who remained engaged in its pursuits. True the first pioneers—those who were actually at work while the first excitement was at its height—were wise enough to sell their fortunes at prices which brought them large profits. First among these stood Messrs. Gessert

Borthers, who sold their at that time flourishing concern to a company, and the English alizarine manufacture, which has since changed hands a second time.

Putting aside a very few German alizarine makers, who profess to work at a profit, we have at present a disheartening list of many large undertakings who are hopelessly insolvent, or at least uncomfortably near to it.

In Germany all public companies are very properly compelled by law to publish their annual balance sheet in at least three newspapers, and such document—published only on the 10th inst., in the *Cologne Gazette*—by the "Chemische Industrie Actien Gesellschaft zu Elberfeld," formerly Gessert Brothers, tells its own tale in a few figures. This official document informs the shareholders that the loss of the twelve months' working, ending at Midsummer last, amounts to £40,000; and as this dismal statement is merely a repetition of previous equally unsatisfactory balance-sheets, there seems to be little doubt that at next month's general meeting the Company will be wound up, and that very likely the whole capital—amounting to some £180,000—will be lost.

Again, a private firm, Messrs. Schœneberg and Hufschmidt, also of Elberfeld, recently suspended payment, with liabilities estimated at £90,000 and assests £60,000, or a deficit of £30,000.

The "Stueckfarberei Gesellschaft" and the "Elberfeld Aniline and Alizarine Gesellschaft," also joint-stock companies, are defunct for some time, their capital having been entirely lost.

Plain facts like these—and the list might easily be made more complete—may well lead to an inquiry into the cause of such calamity. It may be justly argued that bad management, want of skill or proper knowledge in the manufacture, and, above all, the general depression in all trades, especially in the cotton trade and everything depending upon it, have a great deal to do with the non-success of so many undertakings; but I believe the real and primary cause to be the most unhealthy state of the anthracene manufacture.

The fact is the production of anthracene far exceeds its demand, which, suddenly sprung up some years ago, tempted many distillers to manufacture an article of a very doubtful quality; competition unreasonably ran up the price of tar, and the principal benefit was pocketed by the gas companies, and by them alone.

I am induced to give a few figures, which will clearly show this disproportion, and which I feel sure will be very near to the actual truth, because I have every reason to depend upon their correctness.

Up to the end of 1877 there will be produced in England alone, including present stock, at least 1400 tons of *pure* or 100 per cent. anthracene. The requirements of all the alizarine works at present do not exceed two tons a day, or 600 tons a year, of pure anthracene. The next year is expected to see a considerable increase, but if with present low prices we even double the quantity—making it 1200 tons—England alone will produce 200 tons of pure anthracene more than is required.

But it must not be forgotten that the Continent also supplies large quantities. The Paris Gas Company utilise their own residues, and produce, together with the other large French towns, at least 250 tons. Belgium—and more so Holland—is very active, and the production in Germany, especially in large towns, such as Berlin and Hamburg, is not inconsiderable, and even America sends her quota, if not in large quantities. Altogether there will be during 1877 an excess of many hundreds of tons of pure anthracene, and consequently low prices. The inevitable reaction will produce a reduction in the price of tar, which already shows itself in Germany. A paper there offers repeatedly, and for some time, six tar contracts without any response; the distillers bide their time, and their English brethren will soon find out, if they have not done so already, the necessity of this line of action.

But—and here I come to the main point of my argument insisted upon in previous communications—the tar distiller must feel to find his advantage in the manufacture of a better and purer article. He must return to the early times of his operations, when with low tar prices a moderate price for anthracene paid him well.

The large stock accumulating during 1877 may somewhat interfere, but after that the permanently reduced prices of tar will enable him to supply genuine anthracene at paying prices.

It is well known that true, pure anthracene passes over at a certain limited stage of the distillation, and this product only was originally sold; the suddenly increased demand for large quantities induced the distiller to separate as much solid hydrocarbons as possible, and thus the quality of of anthracene deteriorated to such a degree that any article tested by alcohol, and showing a melting-point of 190° C., was sold as anthracene. The increasing impurity of the merchandise called forth improved methods of analysis, until at last the chemist is obliged to demonstrate, by more delicate tests, that most of the anthracene at present in the market is of a very doubtful character.

I think the tar distiller may well bear this in mind, because upon the good quality of anthracene to a great extent depends the future existence of the alizarine manufacturers, and the more flourishing these the better will be the prices of anthracene.—*Chem. News.*

Meeting of Sanitary Engineers at Kidderminster.

The Association of Municipal and Sanitary Engineers and Surveyors held their meeting at Kidderminister on Nov. 3. Mr. J. Leman (Southampton) presided. Mr. Pritchard (Warwick) hon. secretary for the Midland district, and others were present.

Mr G. Cole gave a sketch of the sanitary arrangements of Hereford. That city and its suburbs contained a population of nearly 20,000, but there were not more than 10,000 or 12,000 within the district of the sewerage and water supply. The works were carried out under the direction of Mr. T. Curley, C. E., in 1854, but had been considerably extended since, under his (Mr. Cole's) direction. There was scarcely a house in the city which was not connected with the sewers, all had their water-closets, and nearly all were supplied with the sanitary syphon and trap system, with self-closing valves, and were supplied with water direct from the mains. The surface water was conveyed into the sewers, and when running full flushed them effectually after heavy storms. At other times they were flushed weekly by flush wells, at the end of every street. The sewers were all well ventilated by open gratings in the centre of the street, varying from 50 to 100 yards apart, and no complaints had ever been made of bad smells from these openings. The sewers were further ventilated by rain water pipes when these were not near windows, and in some instances by special 6-inch pipes. The cesspools were for the most part filled up. It had often been his lot to find two or three at gentlemen's houses, and Mr. Cole commented on the danger arising when the imprisoned gases escaped into a house. All sewers and drains should be ventilated as much as possible, and no drain in connection with a sewer should be allowed to enter a house without there being carried up from it a perfectly jointed ventilator. Water-closets should be made outside the external walls of a house, or at any rate adjoining them, so as to admit of free ventilation, not only from the closets themselves, but from the soil below the traps. The water-closets in many instances in Hereford were not properly ventilated, and Mr. Cole remarked that the better class of society ran more danger from this source than the poor. Earth closets had been used, but not found surcessful—it might be through mismanagement. The inspector had been compelled to report them as nuisances, and had caused them to be made into water closets. The great drawback to the Hereford sewerage was that it was made to empty itself into the Wye, and polluted the stream for a considerable distance. The commercial value of sewage was, he thought, generally much over-estimated, but in an agricultural district, if anywhere, it ought to be utilised. The water supply of Hereford was pumped from the Wye, passed through filter beds, and delivered in the usual way. Mr. Cole commented on the waste of water which occurred, and the great unnecessary expense this entailed on the ratepayers. With the object of checking it at Hereford, he had recommended the Town Council to make the use of water meters compulsory as far as possible Mr. Cole tested for a week the quantity of water passing through the meter at the water-works in each of the four hours ending at four A. M., and the average was:—One o'clock, 19,805 gallons; two o'clock, 18,000; three o'clock, 17,571; four o'clock, 17,500. It was obvious that the legitimate use of water at these hours would be very small, and as he had no evidence as to material leakage from the pipes, he was bound to conclude a considerable number of taps were left open, and waste caused, from which no one derived any benefit. Many persons thought they flushed their drains by so doing, but a drain could only be effectually flushed by pouring a quantity of water suddenly into it.

Mr. Lobley (Hanley) said it was a common notion that leaving the water taps running flushed the drains, but he quite concurred with Mr. Cole that it was perfectly valueless, and only caused waste of water. With regard to putting a water meter to every house or few houses, that would require great consideration. It would be very unsatisfactory to cause poor people to use as little water as possible. Waste of water could be checked by the system carried out by Mr. Deacon, at Liverpool. District meters were provided, which showed in what part waste was going on, and this being known, inspectors were able to trace it out and stop it. By this means the waste had been so checked in Liverpool, that under the constant service less water was now used than under the former intermittent system. He was surprised to hear that in a city like Hereford, surrounded by agricultural land, the sewage was not utilized.

The President said when he went to Southampton first he found all the ventilators of the sewers stopped up, and he had great difficulty in getting the prejudice on the point removed. Smells arose, not from the gratings, but rather from the want of them; and at Leeds 14,000 ventilators had been put into the sewers. It was better to have smells in the streets than in the houses. His experience of the waste of water agreed with that of other speakers, and he knew no better plan of detecting it than that of Mr. Deacon, of Liverpool. Local governing bodies ought not to neglect this question of reducing the waste of water. With regard to the value of sewage, the notion that money could be made by it was exploded. If they could even make a sewage farm pay its expenses they were doing a great deal,

Mr. Cole, in replying to criticisms upon his paper, supported his plea for the general use of water meters. Years ago the same objections were made to the general use of gas meters as were now made to water meters; but at the present time gas meters were used by all consumers. He hoped something would be done to teach people the value of water, and nothing would tend more to this than the adoption of the meter system.—*Jour. Society of Arts.*

National Association for the Promotion of Social Science.

[From the London Journal of Gas Lighting, Oct. 24.]

HEALTH SECTION.

At the opening of this Section on Monday, Oct. 16—Mr. Thomas Hawksley, C. E., the President, delivered the following address:

To have been requested to preside on this occasion over an important section of a congress of eminent persons, all earnestly and usefully occupying themselves with studies, investigations, and discussions, having for their object the improvement of the physical, social, and moral condition of the human race, has been to me a matter of the most pleasureable surprise. The position with which you have thus honored me is also all the more gratifying, inasmuch as your present meeting is being held in one of the greatest commercial cities of the world, a city existing under conditions almost, if not entirely, peculiar to itself, and, consequently, presenting to the thoughtful sociologist many subjects worthy of his special consideration.

I shall place before you some of the experiences and conclusions of a man of 70 years, who for the last half century has been occupied in professional avocations, the performance of which has necessarily brought him into frequent communication with the working classes of this kingdom, and has, consequently, afforded him a not inconsiderable insight into their daily lives and habits, and has also enabled him to become somewhat intimately acquainted with their modes of thought, their wants, their expectations, and their aspirations.

The working men and their belongings constitute by very far the largest element of the vast population of this country. It is their interest in the important questions I propose to discuss in this address with which I shall chiefly concern myself; and with this object I shall confine my remarks, for the most part, to matters of a practical character bearing upon the topic of "Health," to which the attention of this section of the Association is more especially directed. Nevertheless, I shall be under the occasional necessity of offering for your consideration some remarks on the cognate subjects of political economy, legislative intervention, and Governmental action, so far, and so ar only, as, in my opinion, they stand directly related to the leading features of my discourse.

For obvious reasons, I shall also confine my remarks to matters affecting the people of England and Wales, which, for brevity's sake, I shall hereafter designate by the word *England* only, and this the rather because each of the sister kingdoms of Scotland and Ireland has her own special sanitary legislation and her own special local government.

The population of England now amounts to 24 million persons, distributed over about 30 million acres of cultivable land. There is, therefore, one person to an acre and a quarter, whereas in most (and averagely in all) of the other kingdoms of Europe, there are about five acres of land to each person; and on the entire surface of the earth (exclusive of the arctic zones) about ten acres of land to each person; or, after a fair deduction for uninhabitable deserts and mountains, probably seven or eight acres of cultivable land to each person. This statement sufficiently indicates the extraordinary density (as it is rather oddly termed) of our English people.

But this is not all, for the absolute increase in the numbers of our population is something enormous; and, looking to the means of living, and the preservation of life and health, this enormous something must become a matter of the greatest and, as I think, most immediate concern and anxiety, alike to the statesman, the legislator, the economist, and the sanitarian. Naturally, the annual ratio of increase, as determined from the excess of births over deaths, is, on a mean of many years, almost exactly that of 10,150 to 10,000; or, in other words, 10,000 people living at the commencement of a year are augmented to 10,150 at its termination. Now, taking our present population at 24 millions, and assuming this ratio of 10,150 to 10,000, and, to simplify the illustration, taking the duration of a current generation at 42 (accurately 41·8) years, as is found by the Registrar-General from his last published Life Tables, the following results may follow:

At the end of the first generation the population of England might become	44,808,000
At the end of the second generation	83,656,000
At the end of the third generation	156,000,000
At the end of the fourth generation	291,000,000
At the end of the fifth generation	544,000,000

And so on, till, in the seventh generation, the people of England and English descent, even if not then all in England, would exceed in number the present population of the whole world; and in 20 generations (little more than the time which has elapsed between the Norman Conquest, when England first became possessed of a rude but stable government, and today) would amount to $24{,}000{,}000 \times (1{\cdot}015)^{20} = 27{,}220{,}000{,}000$, and would require 20 worlds as populous as our earth now is, for their habitation. We shall see by-and-by how very importantly these otherwise apparently frivolous calculations bear upon the subject before us.

But, again, it is said that England is relieved of its superfluous population by emigration to other lands. To a small extent this is true. But I must, before proceeding to measure its effect, beg you to keep in mind the fact that calculation has already shown the impossibility of finding room, either at home or elsewhere, for the teeming millions our country produces. Nor is it any answer for an enlightened statesman to say, "Oh! but something providential will surely happen;" or, "Sufficient for the day is the evil thereof." Yes, something will happen: and I venture, without presumption, to tell you from this place, that the evil is even now upon us. Let us, however, resume our calculations, taking into account the actual effect of emigration upon the ratio of increase. In the year 1801, at a time when the power and counsels of England could make themselves influential in continental affairs, the population was only 8,892,356 while in 1871 it had become no less than 22,712,266 thus exhibiting a mean annual increase of nearly 1·35 per cent.; in other words, 10,000 people living at the commencement of a year became, at its termination, 10,135. We are thus enabled to establish that the annual loss by war and emigration only amounted, over these 70 years, to the difference between 10,150 and 10,135, or 15 persons in every 10,000 of the population. Assuming, however, that this amount of, mainly spontaneous, loss will remain unaltered over a prolonged course of years, how then stands the question we have at this moment under our consideration? Surely thus:

At the end of the first generation the population of England will become	42,000,000
At the end of the second generation	74,000,000
At the end of the third generation	130,000,000
At the end of the fourth generation	230,000,000
At the end of the fifth generation	400,000,000

At the end of the seventh generation more than the world now contains, and at the end of the twentieth generation more than 15 such worlds would contain, each as densely populated as our globe is at present.

Now, what are the inferences to be drawn from these calculations, apart from other momentous facts which I am about to lay before you? It is very obvious that the latter events which the calculations tell us might arise, if they could arise, will never occur, because of their essential impossibility. But what is it that will prevent their occurrence? The world is old, older than any of us can surmise, and it is not filled with people yet. Why is this? Because it has sad stories to tell of famine, war, poverty, destitution, and pestilence; of mouths to be filled, and of an insufficiency of food to be put into them; of diseases to be cured, which the art of the physician has been unable to arrest in their fatal career; of popular discontent, which no government has been able to allay. A sadder picture of a possible future could not be drawn from the evidence of the past. It has, indeed been charmingly said that man is a benefactor to the country, who can make two blades of corn grow where only one had grown heretofore. But, what if the want of two—and that is our present want—becomes the want of four, and eventually the want of ten or twenty blades? Where, then, will our hypothetical benefactor be found?

You are all aware, as familiar facts, that England is already a large importer of food, and that the industrial classes, forming the great bulk of the people of this country, are the chief consumers of these commodities. It may also have occurred to you, that upon the sufficiency and steadiness of these supplies, the comfort and health of these classes are, to a great extent, dependent. I have, however, found that very few of my intimate friends—many of them not only eminent sanitarians, but also well read on subjects of political economy—have so much as suspected the great deficiency of our own resources. Happily for us, during the "piping times of peace," and the prevalence of a "roaring trade," at home and abroad (induced in no small proportion by our demands for foreign assistance), we have been saved from the contemplation of the misery, sickness, and mortality, which inevitably follow in the wake of poverty and famine, however quietly and heroically these may be, for a time, sustained. I am old enough to have seen, and have a vivid remembrance of such painful scenes in our own country; and few of you will have forgotten the extraordinary calamity which befell Ireland, and how little could be done to avert the evils attendant upon it, or even to mitigate the more serious of their effects.

The Customs returns enable us to estimate that about 40 per cent. of the most important articles of the food of the people now comes from abroad, and this, too, for the daily sustentation of the existing population of 24 millions, a per centage which, year by year, will be sensibly added to as the population of our country continues to augment. We look at our Board of Trade and at our Customs returns—we rejoice because we find so many millions of exports, and so many other millions of imports, and we exclaim, with vast exultation, "*Eheu!* was there ever so great a nation as the English?" But we are utterly oblivious of the all-important fact that our exports consist of commodities we cannot eat; whilst our imports consist largely of commodities without which we should surely sicken and starve. Now I ask you, as earnest sociologists, whether a nation can, in the proper sense of the word, truly say of itself, "I am great," so long as it is unable, if need be, to maintain itself? I look, indeed, with alarm to the signs of the times, the general restlessness of European nations, and the possibility of our being entangled in a war—perhaps a war of creeds, ultimately to extend itself to a war of aggrandisement and conquest—for, without in the least doubting the prowess of England, and her ultimate ability to come with glory from the fray, I cannot avoid expressing the apprehension that our supplies of food from abroad may be for a time very seriously interfered with, if not wholly interrupted. With the instance before him of the doings of the *Alabama*—a vessel of war hastily built on the opposite shore of the Mersey—let every patriotic sociologist beseech the Government to look well to its navy, with the object of maintaining our old command of the sea, and for ensuring the protection of that mercantile marine, without the aid of which there can be neither health nor happiness for the multiplying millions of this country.

But the practical sociologist must extend his views beyond the necessities of the hour. The number and consequent density of our population is, year by year, becoming greater, and year by year each individual of us, intentionally or unintentionally, become more earnestly engaged in the disagreeable endeavor to elbow his neighbor out of his way. We rejoice—fatuously, I would say—and sing pæans in praise of the increasing strength and prosperity of the nation—the strength of a noble structure firmly based upon a visible rock, beneath which a mine has been cunningly

laid—when to explode heaven only knows. Would that the warnings of the much-belied Malthus—a far-sighted man of this country—were again listened to and regarded. Would that our Government would exercise itself in that political prevision which looks rather to prevention than cure; for I am well assured that the now-existing waywardness of our working population, its spirit for menacing combinations and trade-unionism, its misguided endeavors to compel the employment of three men to do two men's work, its ignorant belief that increased wages necessarily imply an increased purchasing power, its utter forgetfullness that, as working men are customers one of another, they must eventually lose on the one hand as much as they gain on the other, besides placing themselves and their country in an unfavorable position with other nations trading or competing with us, and also its blind adherence to arbitrary rules and regulations as harassing to the immediate employer as they are annoying to the general public—all have their origin in the apprehension (unfounded though it may be thought to be) that we stand too closely upon the ground to make free and independent action perfectly safe each to each. In my opinion, then, our cry ought to be for "space—more space;" and, looking to the enormous extent of our colonial possessions, it appears to me that a most important opportunity now presents itself, warranting our Government in affording facilities—I do not say inducements—to enable the surplus working man to better his condition, if he so desires, in other suitable climes.

It is essential to the proper understanding of this momentous subject, to bear in mind that augmentation of the population to its present numerical strength has been rapid even to suddenness; and whilst perfectly natural under the exceptional conditions which have produced it, is nevertheless abnormal when viewed from a standpoint which commands a vista of ages and the history of mankind from an earlier period.

We have good reason to believe that when "Domesday Book" was written, the population of England was between four and five millions. In the reign of the Eighth Henry it did not much, if at all, exceed five millions, for the wars and pestilences of the middle ages had effectually checked that very small ratio of growth which is the common incident of nations solely occupied with agricultural pursuits; whilst in the early years of the reign of George III. it is certain that the entire population did not number more than 7½ millions. But then a change in the life of the people suddenly took place. Watt invented his steam engine; Arkwright and Compton invented their spinning-machines. Our wealth of minerals was sought for and found; our manufacturing ability became developed. The wars of the French Revolution and the Great Napoleon occurred. We assumed the control of the sea, and we swept the ships of other nations from its surface. Our commercial supremacy was established, and remained until the second rupture with America, an uncontested fact. Indeed, for nearly half a century we monopolized the manufactures and commerce of the world. Notwithstanding our lavish expenditures on wars and on armaments, and on subsidies, the people became from year to year richer, and as the means of living increased, so did the numbers of the population increase. There is evidence, however, that after the termination of the Napoleonic wars this exceptional condition of things was coming to an end. Bad, though well-intended, legislation with respect to the importation of food brought the people to the verge of starvation, for, even at that period of our recent history, we had ceased to be able to provision the ten or eleven millions to which the population had then increased.

But again fortune favored us. We invented the power-loom, and further improved our spinning machinery; and coals being plentiful, those machines became driven by steam with marvellous rapidity, and because no other nation was, at that time, prepared to follow in our wake, we became the clothiers of the world. Then followed the railways, themselves only the sequel of the steam engine, Neilson's invention of the hot-blast, and the general application of steam in the purposes of navigation; and, finally, a hasty and in some respects injudicious repeal of the corn laws, instead of their proper modification. By this time the population had become sixteen millions; but wealth rolled in; and food, by the aid of our extended commerce, flowed in from every quarter of the globe. Our prosperity, except that of the agricultural interest, was almost unbounded. And then succeeded the gold discoveries which, for a time, stimulated our manufactures and commerce, and certainly saved our agriculturists from the ruin with which they were threatened, for, whilst all other trades commanded the markets of the world, the prices of the farmer were ruled from Poland, Odessa, and America.

Still we got on more than well, for foreign nations had not yet fully awakened to the necessity of providing for themselves, or of entering into competition with us. But then came the shock to our industries in the blind and foolish struggle between capital and labor, between the working man and his employer. Even yet we got on, not very well, indeed, but sufficiently so, for the Continent of Europe and the United States were still, fortunately for us, too fully occupied with actual and contemplated wars and political struggles to attend in an important degree to the full development of their own home resources. In the meantime, although in other branches of trade our progress was not so marked, we had succeeded in bringing our coal and iron trades, and most of the manufactures dependent upon them, to an unexampled state of exaltation. Money and food flowed in even in unwonted abundance, and we became a nation of 22 million people; we had trebled our numbers in a single century.

But soon all this was to undergo a change. A condition of affairs arose, the possibility of which no political economist had forseen, and which political economists had deemed to be impossible. The laborer and capatalist-employer suddenly combined virtually to raise the prices of their commodities against the general public at home and abroad. This unnatural combination for a time succeeded. Everybody was made to pay for the article he wanted, much more than its proper price. The recipients rejoiced. The British public grumbled, and became more careful in their expenditure. The thoughts of other nations became turned in new directions, and they proceeded to make for themselves the articles they could no longer afford to purchase from us, or which, by means of new industries, they could obtain more cheaply, and perhaps of better quality (inasmuch as for many years we had been lowering our standard of quality), either at home or elsewhere than in England. We have thus damaged, I think, irretrievably our manufactures and commerce, and we have brought or are bringing ourselves to a condition which, in my opinion, must end in the impoverishment of the classes which, in their elation at a temporary success of their misconceived movement, have recklessly signed the warrant for the death of their own prosperity. America, Belgium, France, Russia, and Prussia have all been driven to create extensive mining and manufacturing establishments, which, but for our own imprudence in the matters of price and quality, would not have been needed; and some of these establishments are actually supplying the English markets—and that, too, in considerable quantities—with classes of goods of which we have hitherto believed ourselves to be the assured monopolists. Notably I may mention that the finished iron of Belgium is now being supplied to most of the seats of our iron manufacture: and, by way of instance, that Lancashire fire-proof mills are, at the present time, being constructed with Belgian girders; whilst, as you probably know, spinning mills of large capability have arisen in America, France, Russia, India and other places, the productions of which are not generally inferior to those of our own country.

We have, at this moment, an increasing population and a declining trade. Will our statesmen, preoccupied as they are with the struggles of parties, adopt timely measures to avert the otherwise inevitable consequences of our own imprudence, and take steps adequate to the purpose of keeping open the great highway of the ocean for the transmission of the food of, it may well be, unemployed and hungering millions?

[To be continued.]

The Manufacture of Coal Illuminating Gas.*

By Alfred P. Trautwein, M. E.

Continued from page 6.

By far the better plan, however, and the one which is generally adopted in our climate, is to cool the gas by means of a so-called

WATER CONDENSER.

Peclèt has determined the relative efficiency of air and water as the cooling agents for the condenser, and his formulæ, reduced to English units of area and temperature, are as follows:

For air: $Q = 2.94\ [t + .0066\ t^2]$ and
For water: $Q = 15.83\ [t + .105\ t^2]$ in which
Q is the number of thermal units lost by a unit o condensing surface in a unit of time, and
t is the difference in temperature between the gas and the cooling agents.

The following table, deduced from Peclét's formulæ will serve to illustrate the markedly greater efficiency of the water condenser:

Excess of Temperature.	Thermal Units lost by one square foot of Condensing Surface.	
	When Radiating in Air.	When Immersed in Water.
10° Fahr.	31.34	324.51
20° "	66.56	981.46
30° "	105.66	1970.83
40° "	148.64	3292.64
50° "	195.51	4946.87
60° "	246.25	6933.54

The so-called "multi-tubular" condenser, first used by Sabbaton, is the form in which the water condenser is now generally employed. It consists essentially, as its name indicates, of a number of tubes, usually four inches in internal diameter and 12 feet in length, which are placed vertically in sections upon a suitable base, and are entirely immersed in water, which is continually being renewed. By means of proper partition plates in the top and bottom of the condenser, the gas is made to pass up and down the successive series of tubes. The tubes are generally made of cast iron and as thin as a proper regard for their strength will permit; this is also limited by practical difficulties in their manufacture. For these and other reasons wrought iron has been suggested as a material for condenser tubes; its conductivity for heat, at the same time, is somewhat greater than that of cast iron; it has this disadvantage, however, that it is more rapidly destroyed by oxidation. The lower ends of the tubes are turned taper, and are fitted tightly into a corresponding socket in the tube plate. The gas joint between the other end and the upper tube is made by means of lead or hydraulic cement.

It will be observed that in this form of condenser the several series of tubes are surrounded by water having very nearly the same uniform temperature; it is obvious that under these circumstances it is almost impossible to effect a thorough condensation without a large quantity of condensing water. Bearing in mind the fact that the gas should not be cooled too rapidly, since this is liable to cause the condensation of quite an appreciable percentage of valuable illuminating elements. the proper arrangement would evidently consist in so directing the flow of the condensing water, that it shall be opposite to the current of the gas in the tubes. If this principle, already observed in surface condensation in connection with the steam engine, is followed, the efficiency of the condenser is largely increased and condensation is gradually, though thoroughly effected.

It would also be desirable to be able to control the water supply for the several sections, and to adjust it as circumstances may require. This consideration

* A Graduating Thesis at the Stevens Institute of Technology.

lead to the construction of the so-called "sectional condenser," two forms of which—the Mackenzie and the Stanley, have come under our notice. In the former the tubes are very numerous, but have a smaller diameter than in the ordinary multi-tubular condenser, thus subdividing the gas more thoroughly. The peculiarity of the Stanley condenser consists in the tubes, which are made flat and have a section, 3¼" by 9½"; the gas passes up and down the condenser four times before leaving it.

One great advantage of sectional condensers lies in the fact that they can be worked entirely independent of another, each having its own bye-pass.

It is generally admitted that the importance of thorough condensation of the gas at this stage in the process can hardly be over-estimated, since much subsequent purification is thereby saved. That this view is no recent one but one which has long been held very early, indeed, in the history of gas manufacture, is abundantly proven by the existence of such old sayings as "thorough condensation is half purification," and "gas well condensed is half made." It is equally certain, on the other hand, that this condensation should not be carried too far, since such a course would tend to cause the removal of many of the richer hydrocarbons; this limit is usually considered to be at or near 60° Fahr.

It has been found impossible to give a definite rule for the amount of condensing surface required per 1000 cubic feet; the temperature at which the gas enters the condenser continually varies, while in no two cases is the amount of condensable matter the same. English authorities on the subject, it is true, give a number of rules; they are so very arbitrary, however, that they must be considered as of very little practical value, while they are rendered still more useless for our purpose, by the fact that they are applicable only to the case of the air and the common pipe condenser and not to our multi-tubular condenser

The course, therefore, which was resorted to in proportioning the condensers for this particular case, consisted in observing the minimum condensing surface in works already in existence and involving if possible the same or, at least, very nearly the same, conditions. It is hardly necessary to remark that, in almost no two instances was this condensing surface found to be alike, and it thus afforded an excellent opportunity of observing its influence upon the subsequent operations of washing and purifying the gas. It was found in this way, by observing the working of some ten or twelve works both large and small, that the minimum condensing surface per 1000 cubic feet passing the condenser per hour varies from 96—180 square feet; in one instance, though the surface was as low as 84 square feet, no difficulty, whatever, was experienced, and it is asserted by several engineers, that 72 square feet per 1000 feet per hour would be quite sufficient.

It is well, however, to provide, whenever it is possible, a very liberal amount of surface, for reasons too evident to require pointing out here. The condensers in the projected works will, therefore, present a minimum condensing surface of 144 square feet per 1000 cubic feet per hour; this is not only a fair average of the works in this vicinity, but is also regarded by many to be good practice.

If the ordinary form of multi-tubular condenser be used, it would be necessary to provide six sections, each consisting of 40 tubes, 4" in diameter and 12 feet in length. The gas inlet and outlet will be 16" in diameter, and since the total area of cross-section of the tubes is more than twice that of the mains, there need not be any back pressure due to the condenser. A tar overflow, 6" in diameter, carries the surplus tar into the tar-well. The water pipes will be sufficiently large to supply at least twenty-five gallons to the condenser for every 1000 cubic feet of gas condensed, assuming the gas to enter at a temperature of 120° Fahr., being reduced before leaving to 60°. The cover will be detachable for the purpose of cleaning out and making repairs, and consequently an hydraulic seal will be provided along its lower edge. A sufficient number of hand holes will be provided both in the condenser proper and in the mains and bye-pass belonging to it.

Two sectional condensers, each of 250,000 cubic feet capacity, might be used equally well and would, indeed, be preferable in some respects.

It will be observed that in the arrangement of the apparatus as adopted in the projected works, the gas, upon leaving the retort house, will first pass through the exhauster and then through the condenser, thus differing from the majority of works in which the gas is first condensed and then exhausted. Dr. Letheby, the eminent English gas chemist, frequently pointed out the advantages secured by the former arrangement; among others, that condensation is more thoroughly effected. This assertion was based upon the following reasoning: If the exhauster be placed before the condenser it has a tendency to draw off the more volatile impurities, particularly the ammonium compounds from the liquor, thus preventing their partial removal by the condenser. If, on the other hand, the gas be made to pass the exhauster first, as here proposed, it will be condensed under a pressure of several inches of water, due to the holders, purifiers, etc., which certainly has a tendency to promote the condensation of all those constituents which properly ought to be removed. This view is very generally agreed to, though it has but rarely been carried out in practice. The presence of tar in the exhauster can hardly be considered an objection: it serves, indeed, and to quite an extent, the purpose of a lubricant for the internal moving parts. There is still another topic which might properly be considered here, and which will conclude our remarks upon condensation. We refer to the principle, now so well recognized, that the crude gas, on its way to the condenser, should be kept in thorough contact with the hot tar and liquor as long as possible. Experience has shown that under these circumstances a large per centage of carbonic acid and of the sulphur compounds, for which the liquor has a great affinity, is removed while the trouble resulting from naphthaline is entirely overcome. It is very necessary, however, that the temperature of the tar shall be at least 100° Fahr., since its ilmit for the removal of the above impurities is then reached, and since it then begins to eliminate many of the most valuable constituents of the gas.

Now, as to the means by which this is accomplished. It has until recently generally been customary to obtain the requisite tar surface by lengthening the mains leading from the retort-house to the condenser and Clegg gives a rule arbitrary, of course, calling for ten feet of main for every inch in the diameter of the eduction pipe. The obvious inefficiency of this method led to numerous attempts to attain the same end by means of special apparatus, which likewise are generally known as condensers, though their object is rather to keep the gas in contact with the tar and liquor than to cool it. One of the most recent attempts in this direction is the Smith and Farmer Condenser, which is in successful use at New Haven, Ct., and at Morris Plains, N. J. It consists essentially of two or more vertical chambers containing a large number of diagonal plates, so arranged that the gas passes through each chamber with a zig-zag motion, tar and liquor as condensed, descending at the same time in a series of drips at the edge of the plates. The plates are but two inches apart and the apparatus is, therefore, very compact; its remarkable efficiency is equally evident since it presents so great a surface to the gas, while the tar and liquor are as thoroughly utilized as is possible.

In this connection we should not omit to mention the Edge Condenser, though its primary object is simply to remove the naphthaline. Its peculiarity consists in a large number of light vanes or wheels, which are placed either in a suitable vertical chamber or at some convenient point in the mains leading to the condensing apparatus. They are set in rapid motion by the passage of the gas, and the violent churning action thus produced has been found to completely remove the naphthaline or, at least, prevent any tendency to separate in a solid state—its only objectionable form. The Pelouze and Audouin Condenser appears to have been designed far the same purpose, though its principles are of a somewhat different nature. It is a French invention and is of recent date; its introduction is progressing very rapidly on the Continent and it is reported to give satisfactory results; it is now being used or introduced at several works in this country, and it has, indeed, excited considerable attention among gas managers.

If we examine the crude gas before and after it has passed the condensing apparatus, which has thus far been described, we will find that many of the impurities have been removed. These, as previously stated are mainly those hydrocarbons which are too easily condensed to be prrmitted to leave the works with the purified gas. Quite a percentage, however, still remain which are of such a character that they are eliminated only when actually brought into contact with some liquid which has the power of absorbing them. The impurities here referred to are the various ammonium and sulphur compounds, and it is very essential that they are thoroughly removed.

This, for a long time, was accomplished by passing the gas through what was known as a washer. This was a simple oblong box, containing a sheet of water several inches in depth: the gas, entering at one end, was compelled to travel almost the entire length of the box under the surface of the water. This apparatus was not only very inefficient but it caused an objectionable back pressure; for these reasons its use was gradually abandoned, its place being next taken by what is known as the

SCRUBBER.

As now constructed it consists of a tall iron chamber, which is partly filled with some such bulky materials as coke, brick and brushwood—any material, in fact, which presents a large surface; these are kept constantly moist by means of water, or what is better still, as we shall subsequently see, by means of the gas liquor itself. The action of the scrubber, therefore, though mainly chemical, is partly mechanical, since its contents serve the purpose of arresting any particles of tar, etc., which might have escaped the action of the condensing apparatus proper.

Considerable diversity of opinion has existed as to the best scrubbing materials and we shall now endeavor to give a resumé of the advantage and disadvantages connected with those materials now in current use. The duty of the scrubbing materials is twofold; in the first place the object is to present a large amount of wetted surface to the gas, and secondly to retard the progress of the water, at the same time subdividing both it and the gas more thoroughly. Mr. Livesey, of whose scrubber we shall have occasion to speak more particularly, has devoted much attention to this subject, and we shall frequently quote from one of his papers read before the British Association of Gas Managers several years ago. The principles which have to be kept in view in selecting a scrubber are there stated as follows:

"First. The gas should travel as slowly and freely as possible and, therefore, with the minimum of pressure and resistance.

"Second. In its passage it should be brought into contact with the largest possible wetted surface.

"Third. In order to comply with the first condition, the scrubbing material should occupy as little as possible of the space in the scrubber.

"Fourth. The scrubbing material should not be liable to get choked with tar and naphthaline, and consequenlly not require changing.

"Fifth. In order to obtain strong liquor, the water should be distributed all over and in very small quantity, this being also necessary to avoid impoverishing the gas."

We will now see to what extent scrubbers in general, and our scrubbing materials in particular, comply with the above conditions.

[To be continued.]

Illuminating Power of Coal Gas.

[From the London Journal of Gas Lighting, Nov. 14.]

[Concluded from page 9.]

Dr. Pole said it might perhaps be useful to state what was actually done in regard to testing gas, and the employment of burners in London. The ordinary method of testing gas was by means of the photometer, by putting a gas flame on one side of the disc and a standard candle on the other, and comparing the effect of the two in the usual way. Then the question arose as to what kind of burner should be used. Dr. Letheby had given a good historical account of what had been done with regard to burners, and he (Dr. Pole) would take it up at about the point when the Act of 1868 was passed, which directed for the first time, on a good scientific basis, the testing of gas throughout London, and when a new clause was introduced with regard to the construction of the burner. It was not attempted to define what kind of burner should be used, but the clause left it to the Gas Referees to prescribe the burner. The burner shall be such as shall be the most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by the consumer. The illuminating power of gas varied immensely, according to the burner used; it was supposed a sensible consumer would get the best burner he could, and the company, of course, had a right to have their gas tested by that burner. It came to the same thing as saying that the company should have their gas tested by the best burner which could be used by the consumer, and that was how the legislation stood at this moment. The Referees examined a great number of burners, and chose the one called Sugg's Standard "London" Burner as answering that condition; and that it had been used by the public was proved by its large sale. It also gave a pretty high illuminating power to the gas tested by it. It was prescribed by the Referees, and had been in use ever sine, being considered a very good burner. Then came another question, the quantity of gas passed and here it was found that the same burner would give different results with gas of the same power, according to the quantity which passed through it. Thus 5 cubic feet an hour passed through a burner would give one result, but if in the same burner only 2½ cubic feet an hour were burnt it would not give the same proportionate result as before. He had occasion to go into the cause of this some time since, and found a curious law applicable to burners generally. It was expressed by the equation

$$L = m\,I\,(q - c).$$

Supposing L to be the light given off by the flame of a burner, I the illuminating power of the gas, and q the number of cubic feet of gas burnt, per hour; m and c were two constants, and that equation would give for all burners he had tried the light given out by burning a certain quantity of gas. The values of m and c came out as follows:—For Argand burners generally, m varied, according to the goodness of the burner, from 0·2 to 0·33, and c was pretty nearly 2; for flat-flame burners m varied from 0·1 to 0·2, and c was about 0·5. The inference was, with whichever burner, that the more gas burnt in the burner—that was, up to its maximum power, so that it did not smoke—the better was the result obtained. That led to this, that since the burner ought to burn the gas to the best advantage, it was necessary to have the flame pretty high, and the standard "London" Argand was made so as to burn about 5 feet an hour without smoking. That was how the burners used in testing gas in London had been arranged. Then came this difficulty. The gas of course varied in power; no gas-works could keep their gas always of the same strength: sometimes it was a little less than at other times, and sometimes more. When the illuminating power of the gas increased there was a tendency to smoke and flare above the chimney, and that had to be corrected. The examiners could not alter the quantity, because the Act mentioned 5 feet an hour; all they could do was to check the smoking by putting on a different chimney, which did the gas harm. On the other hand, if the power of the gas diminished, then the burner was not doing its best, as the flame became too low. Now, without going so far as Mr. Sugg had done by changing the plan altogether, the liberty of altering the quantity would, he thought, be a great convenience; when the gas became of a higher illuminating power, the quantity could be reduced, and when it had a lower illuminating power, the quantity could be a little increased. This would have another advantage, inasmuch as it would represent more nearly what the public did. The public, in using the gas, kept the flame at pretty nearly the same height, and if the gas was too rich, rather than have it smoke, they turned it down, or if it was too poor, they increased it. Hence, the power of varying the quantity in testing the gas, according to the illuminating power, would in reality correspond to the ordinary conditions obtaining in practical use, and this was one of the objects aimed at by the Legislature. He then referred to the late discoveries of Mr. Crookes, particularly as to the possibility of measuring the intensity of light by its mechanical radiating force, and he described, at some length, the several ingenious methods by which Mr. Crookes, in a paper lately read before the Royal Society,* had shown how the intensity might not only be accurately measured, but automatcally recorded. He did not assert that these instruments were at present in a position to be used for a photomatical purpose of the importance of gas-testing in London; but Mr. Crookes's discoveries contained the germ of a great improvement, which might one day be of considerable value.

Mr. J. N. Douglass considered there must be some mistake on Mr. Vernon Harcourt's part as to the power of the flame being due to its length. He did not think Mr. Sugg could mean that a flame 3 inches long, giving a light equal to 16 candles, could not be shortened without impairing its intensity. In lighthouse burners it was desirable to confine the length of the flame, and indeed to obtain a flame nearly spherical, for the purpose of utilizing it more completely by the optical apparatus; and he had found that such a flame as that of the Sugg burner could be reduced to less than half its length, still retaining the same illuminating power. Nearly three years ago he had to apply, for the first time, Argand gas-burners in the focus of parabolic reflectors for the Caistor leading lights of Yarmouth. He tried several gas-burners, and among them Sugg's "London" Argand burner, which he found to be the best; but still the flame of this burner was too long for the purpose, it being about one inch in diameter, and 3 inches in length. He therefore made some experiments, basing them upon the principles adopted in the improved "Trinity House" oil burners for obtaining perfect combustion and the required form of flame. He succeeded in arriving at the desired result, and also in attaining nearly the same economy in combustion as had been found in the improved "Trinity House" oil burners. On comparing the new one with the Sugg burner of the same dimensions and number of holes, the two consuming the same quantity of gas— viz., 5 cubic feet per hour, he obtained nearly 33 per cent. more light with the former. He submitted the burner to the Elder Brethren of the Trinity House and to their scientific adviser, Dr. Tyndall, and took it to Mr. Sugg, who tested it with the same results, and who afterwards made the burners for the Caistor lights, which had been in use ever since. Mr. Sugg had since modified his "London" burner somewhat in accordance with the one referred to. The original "London" had a cone, but no central deflector or button, and their was no air passage between the cone and the glass chimney. The improved burner was the most perfect Argand burner he had yet met with for general lighting purposes. The use of inner and outer deflectors to Argand gas and oil lamps had been patented by Mr. W. Wilkins, in 1862-3. By the application of these deflectors, and other improvements to oil burners, he had found that with the present "Trinity House" improved lighthouse burners, which were adapted for burning either animal, vegetable, or mineral oils, when consuming colza oil the standard had been raised 39 38 per cent.—*i.e.*, the illuminating power had been increased 22 per cent., with a reduction in the consumption of oil of 17·38 per cent. If considered economically, irrespective of the increased power per burner, a saving of oil had been effected of 32·47 per cent. These results were sufficient to show the importance of an efficient gas or oil burner. At the same time, it could not be too clearly kept in view, in adopting a standard burner for estimating the illuminating power of coal gas, that as the efficiency of such a burner was improved the specified candle power of coal gas would be raised *pro rata*, otherwise the benefit to be derived by such improvement would fall to the gas companies instead of to the public.

Professor W. G. Adams observed that it had been pretty general admitted that the means of estimating the illuminating power of coal gas was in an unsatisfactory state. This was true of the power of measuring as well as of the power of producing the illuminating power: and all existing photometers were defective in that they relied on comparisons made by the eye of the observer between illuminations from two distinct sources. Attention had been drawn to another method of measuring the intensity of light by means of the radiometer, invented by Mr. Crookes, where the action of light and heat falling on a pith disc, which was blackened on one side, caused it to rotate, thus establishing a direct relation between two of the physical forces, radiant heat or light and motion. He wished to draw attention to the direct relation between two other of the physical forces, light and electricity, which was established three years ago by Mr. Willoughby Smith, who discovered that when light fell upon a piece of crystalline selenium which was in an electric circuit with a battery and galvanometer, the electrical resistance of the selenium was diminished by the exposure. During the last two years Professor Adams had been experimenting on this subject, and his results had been laid before the Royal Society.* They seemed to show that those rays of the spectrum which produced light were the rays to which chiefly, if not entirely, the change of electrial resistance was due. The dark heat rays produced little or no effect on the electrical resistance of the selenium. He had enclosed pieces of crystalline selenium in a box with a lid to exclude the light, the bottom of the box being made of ebonite, into which were fixed the binding screws for supporting the selenium, and making contact with the electrical circuit. The resistance of the selenium was balanced, before exposure, by a high resistance formed of a thick black-lead pencil mark on ebonite, which was varnished with a thin coating of shellac varnish. The spot of light of a delicate reflecting galvanometer was then at the zero of the scale. On opening the lid of the box the resistance of the selenium was diminished, and the spot of light travelled along the scale. Several series of experiments had been made to determine the relation between the intensity of the light and the change of resistance which it produced. The intensities of different sources of light had been compared by means of Bunsen's photometer, and the change due to the exposure to these sources had been determined by the throw of the galvanometer needle, the duration of each exposure being ten seconds. In one series of experiments, the action of a single candle placed at different distances from the selenium had been measured, and compared with the action of an Argand lamp of the illuminating power of 16 candles. The following deflections of the needle were obtained:

	At ¼ Meter.	At ½ Meter.	At 1 Meter.	At 2 Meters.
With the Argand lamp	—	170	83	39
With one candle.....	82	40	18	8

In another series of experiments, with a different

* *Vide* "Proceedings of the Royal Society," vol. xxiv., p. 282.

* *Vide* "Proceedings of the Royal Society," vol. xxiv., p. 163.

piece of selenium exposed to the light of a single candle at varying distances, the results were—

	At ¼ Meter.	At ½ Meter.	At 1 Meter.
With one candle.....	45	25	15
With one candle.....	40	20	10

The results obtained showed that the action of the light during exposure for ten seconds, as indicated by the throw of the galvanometer needle, was inversely as the distance of the source of light—*i.e.*, directly as the square root of the illuminating power. Hence, with the selenium photometer, when two sources of light at different distances produced the same change of resistance in the selenium, their illuminating powers were directly as the squares of their distances from the selenium. Not only might the relative illuminating powers of the two sources of light be compared by this photometer, but a direct relation might be obtained between the illuminating power of the light and the change of resistance produced by it in a given piece of crystalline selenium at a given temperature.

Mr. Sugg, in reply, said he had placed on the table the jet photometer, to illustrate the difference between it and the Illuminating Power Meter, and that it might be seen how far the results corresponded in the manner mentioned by Mr. Vernon Harcourt. Dr. Letheby had referred to the variations in the illuminating power of the standard sperm candles. This subject had already been brought before the Institution in a paper by Mr. T. N. Kirkham, M. Inst. C. E.,† in which the results were given of a great number of those experiments—especially of one series made in conjunction with Dr. Odling, and in which he found there was a difierence, ranging as high as five candles, in the estimation of 14-candle gas. That arose in this manner: Dr. Odling purchased the candles in different places, and the difference in their manufacture was sufficient to cause the wide variation of five candles. Dr. Odling was quite satisfied at that time that the candles were not a reliable standard. By making them carefully, that error had been mitigated; but it was still open to inspectors testing gas throughout the kingdom, except those testing under the Gas Referees, to buy their candles wherever they liked; and if those candles were adulterated with paraffin or stearine, there was sure to be a difference in the illuminating power shown. The object of the Illuminating Power Meter was principally to have a check upon the candles; and he did not propose, as Dr. Letheby seemed to imagine, to do away with the ordinary photometric test, but simply to put, at one end of the photometer, his standard burner, which would always give a light equal to 16 sperm candles, so as to check the candles if they did not burn properly. He had made a number of experiments with these candles in comparison with the standard burner, and found that the candles gave a different result, varying from 15 to 17; whereas the flame had always been supplied by the same quality of gas, and, therefore, there could be no variation. With respect to the Birmingham burner, Dr. Letheby remarked that, probably, now that the authorities had taken the matter of gas into their own hands, they would regret the adoption of the Birmingham standard burner for the purpose of testing the quality of the gas. At the present moment they had escaped from that difficulty by adopting the "London" standard burner; but in other cases where the Birmingham burner had been adopted, they would, no doubt, have to contend with the difficulty of getting bad results. The burner placed upon the meter was an ordinary consumer's burner, and not specially made for the purpose of the photometer. Mr. Vernon Harcourt thought there would be a difficulty in reading the exact height by inches, because of inequalities in the height of the flame. Supposing a burner were made expressly for photometric purposes, no doubt the flame could be kept perfectly level on the top; but the slight variations in that standard burner did not make any appreciable difference. Several members of the Institution had tried the regulation of the flame themselves, and the only difference was about half a candle—not a great difference when it was remembered that they had never seen the instrument before. Mr. Vernon Harcourt had also spoken of the more easy method of reading the height with the jet photometer. This instrument showed the illuminating power of the gas in a manner somewhat similar to the Illuminating Power Meter—namely, by the height of the flame. If the gas was rich, the flame went up higher; and if poor, the flame was low. By regulating always to one height of flame, and reading off the pressure required to give that height of flame, a correct estimate could be formed of the illuminating power of the gas. There was only one difficulty, which he hoped to remove, and that was the difficulty of the standard burner. For every quality of gas at the present moment a different standard burner was required; and as they all differed among themselves, it was difficult to fix the readings of the jet photometer to any particular point which would be universally correct; for if it was correct for one standard burner, it was sure to be wrong for another. That difficulty was again complicated, because with gas beyond 20 candles the Argand burner was replaced by a burner which gave a flat flame, and the flat-flamed burner gave a higher result for the higher illuminating power of the gases than it ought to. Up to 30-candle gas it made a difference of about three candles. That difficulty did not exist with the Illuminating Power Meter, because it was adapted for gas from 12 candles to 32 candles; and although with 35-candle gas there seemed to be a little difference, it depended upon the chimney placed over the flame. If a long chimney was put on, which favored the richer gas and deteriorated the poorer, it would give the benefit to the richer gas; but by putting a chimney suitable to both kinds, the illuminating power of the burner could be made exactly the same, whether for 12 or for 35 candle gas. Dr. Pole mentioned that, according to law, official testing must be made with 5 cubic feet of gas; but it was known that for a long time that had not been complied with. In the case of Birmingham, in particular, if the gas was over 14 candles, it used to flare over the chimney, and it therefore became necessary to reduce the quantity; and so also in many other places. In London it was not so done, because the Gas Referees had made a provision to avoid it. They said that when the gas was so rich that it tailed over the top of the chimney, a still longer chimney should be put on. If that was done in London, it was just as easy to do it in other places, as Birmingham, where the burners would not consume the proper quantity of gas. His proposition was to provide one standard burner for all qualities of gas, by which means all difficulty was avoided, simply by reducing the quantity of gas used in accordance with its richness; and so correctly and proportionately to estimate the quality of the gas burned. With respect to the radiometer, there appeared to be some difficulty in its application to gas photometrical purposes. It certainly went round fastest with the hottest burner; and it would go round as fast with a heated poker as it would with the burner. No doubt the movement was as much affected by heat as by light; but with one standard burner and one height of flame, if the radiometer was placed at a sufficient distance, that difficulty might be got over to a great extent. Also if the number of revolutions could be reduced, it might be possible to check the accuracy of the burner, and so have another check upon the sperm candle, or perhaps eventually do without sperm candles, at all.

† *Vide* "Minutes of Proceedings Inst. C. E.," vol. xxviii., p. 440.

Natural Gas.—There are now three gas producing wells at Beaver Falls, Pa. one of which has been in operation over seventeen years. Two of the wells are nearly 1100 feet in depth, one having been reamed out, and is said to produce about 100,000 feet per day, which is utilized in the cutlery works, except what is used in the gas-lighting works, where it supplies about 60 per cent. of what is used. The other well is to be bored out to eight inches. The third well is recently bored and struck a good vein of gas at 500 feet. This well is to be cased twelve inches, with a small tube inside to continue the boring to a greater depth, while the present product of gas, which is much greater than the other wells, can be utilized.—*Coal Trade Journal.*

English Gas Coals.

Some idea may be formed of the relative value of the different kinds of coal used in Great Britain for gas making, by reference to the following table, which exhibits the proportions of volatile matter, coke, and ash, produced by each description of coal. The coals are arranged in the order of their gas-producing properties; and it will be seen that the amount of volatile matter ranges between 23 and 68 per cent.

Name of Coal.	Vol. Matter.	Coke.	Ash.
Boghead.....	68.4	31.6	22.8
New Brunswick Cannel...	66.3	33.7	0.6
Kirkness.....	60.0	40.0	13.5
Capeldrae.....	54.5	45.5	10.5
Old Wemyss.....	52.5	47.5	15.1
Staffordshire Cannel.....	50.0	50.0	2.9
Lesmahago.....	49.6	50.4	9.1
Knightswood.....	48.5	51.5	2.4
Arniston.....	45.5	54.5	4.2
Heathern (Stafford).....	42.9	57.1	1.8
Ruabon main (N. Wales)	41.5	58.5	1.0
Stavely (Derby).....	40.9	59.1	2.7
Radstock (Somerset).....	38.3	61.7	3.5
Silkstone (Yorkshire)....	38.0	62.0	2.6
Blenkinsopp.....	38.0	62.0	5.1
Wigan (Lancashire).....	37.0	63.0	3.0
Mortomly (S. York).....	37.0	63.0	1.6
Elsecar (Yorkshire).....	37.0	63.0	1.1
Ramsay (Newcastle).....	36.8	63.2	6.6
Hastings' Hartley.....	36.5	63.4	2.0
South Tyne.....	36.3	63.7	3.9
West Hartley.....	35.8	64.2	4.7
Grigleston Cliff.....	35.6	64.4	1.6
Gosforth.....	35.0	65.0	1.0
Soap-house Pit.....	35.0	65.0	0.8
Nailsea (Somerset).....	34.9	65.1	3.0
Leverson's Wallsend.....	34.9	65.1	4.9
Arley (Lancashire).....	33.7	66.3	3.6
Lockgelley Cannel.....	33.5	66.5	13.1
Woodthorpe (S. York)...	33.1	66.9	10.5
Pelton Main Cannel.....	31·5	68.5	9.4
Washington.....	31.3	68.7	2.2
Pelaw Main.....	30.3	69.7	2.6
New Pelton.....	30.2	69.8	1.8
Coal-pit Heath.....	30.1	69.9	5.8
Garesfield.....	29.4	70.6	1.0
Dean's Primrose.....	29.3	70.7	2.4
Urpeth	28.7	71.3	1.4
Pelton main.....	28.4	71.6	1.4
South Peareth.....	27.8	72.2	1.8
Cumberland.....	25.6	74.4	1.4
Rhonda (S. Wales).....	23.1	76.9	2.1

—*Coal Trade Journal, vol.* xii—22.

Natural Gas.—Experiments in the use of natural gas for heating purposes far removed from the well, show that the pressure is much reduced in conducting it any great distance. In puddling with this gas at Etna Borough, 19 miles from the well, the pressure was reduced from 80 pounds at the well to 17 pounds at the furnaces. Analyses of the gas showed the presence of quantities of marsh gas, and it was found that the furnace worked more satisfactorily by the use of a little coal in connection with the gas. A special furnace was found necessary, the gas and air being heated before burning. It was estimated that 4,000 cubic feet of gas at one pound pressure were required to puddle a ton of iron. The failure of the apparatus to thoroughly mix the air and the heavy gases, to burn them to carbonic acid, resulted in the production of iron containing an unusually large per cent of phosphorus. With the Robertson gas furnace a better result was effected, although the amount of phosphorus in the finished iron was 0.36 per cent. Natural gas in Pennsylvania contains varying proportions of free hydrogen, the specific gravity changing accordingly, and in those wells which give out gas freely the pressure changes during the day, being greatest about 9 A.M. and 4 P.M. Additional wells affect those already in use.—*Exchange.*

Paris Gas Company.—The revenue of the Parisian Company for Lighting and Heating by Gas amounted in the first months of this year to £1,078,993. This total presented an increase of 6·50 per cent., as compared with the corresponding period of 1875.—*Exchange.*

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—Ed.

Tar as Fuel.

New York, January 8, 1877.

Mr. Editor: I read with much interest the article in the Journal of the 2nd inst., on "Tar as Fuel.' The writer evidently understands the subject, and has explained it with more than customary clearness. The question is a somewhat complicated one, and it is not therefore a matter of wonder that an error should occasionally creep in, when calculating the heating values of compound substances. It appears to be a common mistake in estimating the calorific power of petroleum and tar, to make deductions which lessen the heating power, when the elements deducted really produce the opposite result, adding to rather than subtracting from the calorific effect of the fuel; and this seems to be the more noticeable in view of the fact that practice, on a large as well as experimental scale, demonstrates that the actual heating power of tar and petroleum is larger than the calculated power. Something ought, therefore, to be added to the power of the fuel as usually calculated, rather than any deductions be made therefrom. It is true that the evaporative effect realized from any fuel cannot exceed its full *inherent* power, but it may exceed the theoretical, and might, without any stretch of imagination, exceed the calculated power, because the calculation may be incorrect or may be based on a wrong theory. An error of this kind appears in the article referred to. After giving the proximate composition of coal tar, in which there is 4.77 per cent. of hydrogen and 1.27 per cent. of oxygen, the writer remarks that the free oxygen in the tar requires one-eighth of its weight of hydrogen to form water, which reduces the calorific effects of the hydrogen to that extent, and he deducts from the actual per centage of hydrogen .158 per cent., leaving only 4.61 H for the development of heat, which amounts to 2883 heat anits. Now, the effect of the oxygen is to *increase* the heating power of the tar instead of lessening it, because first, in uniting with the hydrogen to form watery vapor, the hydrogen is simply consumed, precisely the same as if burned in air; secondly, the oxygen being present in the tar and being gradually and intensely heated by its combustion, it is necessarily of a higher temperature than if introduced cold with atmospheric air, and therefore its union with the hydrogen is more rapid and energetic, producing a greater degree of heat: thirdly, in consequence of its presence, less oxygen is required to be introduced into the furnace from the exterior, and a proportional less weight of nitrogen is introduced. Nitrogen not only has no heating power, but being *inert* it abstracts just as much heat as is requisite to raise it to the temperature of the furnace. In every pound of tar there are .0127 pounds of oxygen, which is equivalent to .0425 pounds of nitrogen; .0425 lbs. of nitrogen require .0004 lbs. of hydrogen (.0425 × 2400 = .0004) to heat it to the temperature

254.437

of the furnace. In consequence of this saving the quantity of the theoretically effective hydrogen should be 4.77 + .04 = 4.81, instead of 4.61 as given.

Again, the article goes on to state that there is 9.91 per cent. of water in every pound of tar, and that an allowance must be made for the evaporation of this water, requiring a further deduction of 111 units of heat. Here, I think, the article is very seriously in error, as will appear from the following considerations. First, we know by observation that if while tar is being burned, water, even if cold, is dropped upon it, not too rapidly, there is an instant flash of white light with increased heat, resulting from the decomposition of the water into its component gases, H and O, and their instant combustion. We also know that when a large fire has gained a certain headway, water poured upon it only adds to its intensity instead of putting it out. The fact is, the water becomes a part of the fuel, and is consumed the same as wood or oil would be. This is the case with the nine per cent. of water in the tar. Secondly, when the units of heat of any substance is being ascertained, the heating of it to the degree necessary for its consumption is inclusive; for instance, when hydrogen or carbon are burned in air, the gradual heating of them to the point of combustion, while they are being consumed, is included in the heat of combustion, the heat of combustion or the units of heat being the available balance of *caloric* which remains to produce the heating effect after the heat necessary to the combustion of the substance is attained, just as the actual working power of a steam engine is its power less the loss by condensation, friction, etc.

The calorific effect of the ·0991 lbs. of water is estimated on the following basis: ·0991 lbs. of water contain ·011 lbs. of hydrogen, which should be added to the free hydrogen in the tar as obtained by the analysis, and ·0881 lbs. of oxygen, which is equivalent to .0028 lbs. of hydrogen, since by its presence it saves the heating of .295 lbs. of nitrogen, which requires, in the method stated above, .0028 lbs. of hydrogen to bring it up to the heat of the furnace. The saving by the presence of the oxygen and water is equivalent to at least .0032 lbs· of hydrogen.

It will be remembered that there are .1008 lbs. of oxygen in the tar, saving heat on the one hand and creating it on the other, and making a saving of at least .00085 lbs. of hydrogen.

Oxygen combines with carbon when in a liquid state at a much less temperature than when the carbon is solid, say one half or 750° for .8288 lbs. of carbon, which is equivalent to .00244 lbs. of hydrogen.

We are now prepared to calculate the calorific power of the tar.

Carbon	82.88×13268	10.996	units of heat
Hydrogen	$4.77 + .04 + .28 + 1.10 + .085 + .244 = 6.52 \times 62.535 =$	4077	" "
		15073	" "
Add for the sulphur.....		63	" "
Total.....		15136	" "
If the calorific power of the coke is, as given.....		10970	" "
That of the tar exceeds it by....		4166	" "

which is a gain of 38 per cent. instead of 22.7 per cent.

The difference between the heating power of common illuminating gas when burned ont of a fishtail or batwing burner, and in a Bunsen burner, is known to every one conversant with the matter. The increase of heat in the latter case is owing to the intimate intermingling of the oxygen with the gas, and the prompt and perfect combination of the oxygen and hydrogen, producing an intense heat, which consumes the carbon or converts it into CO_2, before it can become incandescent and show a white heat. The result is heat instead of light. The action in the flame is less diffused than with the ordinary burner; that is, it is concentrated and intense, the difference in the attending conditions making a difference in the results. In like manner, the liquid hydrocarbon being a *fused* carbon as compared with coal or coke, being more easily vaporized, and the oxygen of the air being easily and intimately intermingled with the vapors, there is more energetic chemical action and a more intense heat. Assuming the increase of the heating power to be one third, and having already obtained 15.136 units of heat, there results a total heating power of 20.181 units, or about double that of the coke. This result corresponds nearly with practice, it being, I believe, generally conceded that the heat of combustion of heavy liquid hydrocarbons is fully twice that of solid fuel, when the conditions for a perfect combustion are attended to.

The units of heat of coal tar have not been scientifically determined, but it appears that the calorific power of hydrocarbons is proportionate to the density of their vapors. The heat of combustion of petroleum is 18,000 units, and therefore it may be assumed that that of coal tar is no less—one pound of coal tar would consequently give about 20,000 heat units, as found above.

It will be perceived that some of the above details vary from the accepted methods of estimating the heat units of compound substances, but they will, I think, be found to be based on facts, and to agree with what is known of the subject, and confirmed by experience. J.

Foreign Gas Works.

London, December 16, 1876.

Mr. Editor: I have, during the last eight months, visited a great many gas works on this side of the water, from the Metropolitan of the first magnitude to the small village establishment.

I came to Europe to make some investigations in connection with gas matters, and knowing it would interest many of your readers, friends of mine in the "fraternity," to all of whom it would be impossible to write, I concluded your columns would be a proper way of reaching them, the more so as I am aware of the desire of all engaged in the gas business, to know how their efforts and results compare with those of their European brethren, but as I expect to return to the States early in the spring of 1877, I will not attempt entering into details in this communication, but satisfy myself with being general, and from my knowledge of the gas undertakings of the United States, I am proud to be able to feel somewhat generous when comparing our progress with that of the "mother countries." What I was most impressed with in England and Scotland was the close economy practised in the retort-house, the great care taken in the working of the retorts, the proper regard for the perfectness of the "setting," they being various and novel, but all having in view the saving of fuel, and being adapted to meet the requirements of locality, in respect to the particular coal used, by this I mean the settings, etc., in Scotland where they have Cannel being much different from those in use in England where it is bituminous, but in both countries the carbonizing of a ton of coal with the least possible fuel has been brought down to a very fine point.

The coals of England and Scotland, as in the States, are of a varied quality and great attention is given to the mixing of them, the use of the best and poorest qualities combined giving very satisfactory results. The manager of a gas works told me how he almost made a handsome dividend, yearly, for his company, in economising what had formerly gone to waste. I was somewhat surprised at what he did show me. From the fact that the laws are very stringent as to quality, etc., managers here are compelled to be more observant and particular as regards purification and power. The average loss in distribution is very small. In general construction of buildings, etc., most of our works are built upon better principles, and the machinery in the States seems to me, some how or another, to be better finished and more carefully put up.

There is hardly a village here but has its gas works, and I have failed to find one that does not pay on the amount invested.

Trusting these few lines will be viewed as the friendly opinion of one who has carefully examined both sides, I remain your obedient,

L. M. Moyes.

The Danger of Lampblack.—Within three years, says the *Commercial* (Boston) *Bulletin*, there have been three shops destroyed in Massachusetts from lampblack. A hand damp with perspiration, a drop of water, a bit of grease, or a sprinkle of oil, will create the combustion which will start the lampblack aglow like charcoal, and so ignite the package, and hence the blaze. In lampblack factories, while great precaution is taken to prevent fires, a rainy or sharp frosty day will start a dampness upon the inside of a window pane, and the flying particles of dust lighting upon this creates a spark which, communicating with the pile, sends a glow of fire with wonderful rapidity through the galleries of the shop. In cleaning up the smoke galleries, if the men let a drop of perspiration fall into a pile, they instantly scoop up the lampblack in and about where it lodges, and carry it out of the house.—*Manufacturer and Builder.*

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TUESDAY, JANUARY 16, 1877.

A System for Preventing the Deposition of Naphthaline Crystals and for other Purposes.

BY THOMAS CURLEY, WILMINGTON, DEL.

To Superindents of Gas Works.

The products of the distillation of coal are classed under three heads namely: the gaseous, the liquid and the solid, among the latter, naphthaline takes its place, by reason of the large amount of carbon which its atom contains, and which precludes its retention in a gaseous or vaporous state, except through the agency of a solvent substance, but in the absence of such solvent it will follow the law of its nature and crystallize.

This substance, in its (present) crystallized condition was unknown to our predecessors, but, with the era of clay retorts, high heats and the general desire of the manufacturer to keep pace with other branches of industry, and produce gas at the lowest possible cost, we have it in abundance. The question having been discussed at the various meetings of the A. Gas Light Association, the results are known to the profession. It was seriously recommended to keep the gas in contact with the tar much longer than usual, and thereby allow the tar to absorb (out of the gas) these naphthaline vapors Again, it is recommended to reduce the temperature of our retorts, or in other words, go back twenty years again to use steam and solvents, or solvents alone; to saturate lime with naphtha and to make oil gas. The four latter systems or suggestions, or any one of them, may be taken relatively as to their cost and their practical application, in other words, will the extra amount of gas produced pay for the expense incurred by their use?

The proposition to keep the gas in contact with the tar as long as possible in the ordinary way is, according to chemical science and practice, a backward step in the science of gas manufacture, and very few, I dare say, will be found to adopt it, it being essentially a system which deprives the gas not only of its naphthaline vapors, but, unfortunately will deprive it of a large quantity of the light hydrocarbon vapors whose presence in the gas adds so much to its illuminating power.

Knowing that the benzole and naphtha series of hydrocarbons are powerful solvents of naphthaline, and knowing furthermore, that the coal tar contained more or less of these oils, the question suggested itself, why not expel these oils from the tar, where they are of no use, and utilize them as solvents for the naphthaline, by their mixture with the gas in a vaporous state, thereby neutralizing the tendency of the naphthaline vapors to crystallize and the enriching of the gas by their presence to the extent of from ten to fifteen per cent.

The system which I have the honor of presenting for your consideration, and which has occupied my mind for some considerable length of time previous to its adoption, particularly in relation to its mechanical arrangement, simplicity of details and inexpensiveness, is this: I cause the ammonical liquor and tar to run directly from the hydraulic main into a box, say 12 × 18 × 36 inches, placed just below the level of the main; here the tar is separated from the ammonical liquor the tar flowing into an adjoining tank 3 feet in diameter and 3 feet high, made of No. 10 iron, in this tank I have a small coil of steam pipe and by the agency of steam, or exhaust steam, I keep the tar at such a temperature as will expel the light hydrocarbon vapors, which the tar holds in solution, and their subsequent mixture with the gas. The result is what I anticipated, the non appearance of naphthaline crystals and a vastly increased illuminating power of the gas. The ammonical liquor may be conducted from the separator to any desired place. The overflow from the tar tank conveys the tar to the tar well, if found necessary; I, however, convey it to the furnace where it is consumed instead of coke. I use no coke whatsoever in the tar furnace. Even the expense of pumping the tar for consumption in the furnace is obviated, and the flow of tar to the point of combustion is more steady consequent upon its uniform temperature.

In reference to the cost of tank and separator, I would say that for our works their cost was less than eighty dollars. The tank and separator here described are sufficiently large for works producing from 40 to 60,000,000 cubic feet per year.

Any further information desired respecting the machine will be cheerfully given by addressing the patentee,

THOMAS CURLEY,
Wilmington Del.

Gas-Light Intelligence.

United States.

ADVANCE IN THE PRICE OF KEROSENE.—It's about as broad as it is long. Many people, after discarding gas for kerosence, find the latter commodity suddenly advanced from eight to forty cents a quart.—*Com. Advertiser.*

A THEATRE GAS BILL.—A six months gas bill was sent in to the managers of the Bowery Theatre by the New York Mutual Gas Light Company, amounting to over $400. The managers of the Bowery objected to paying such an exorbitant bill, alleging that "the one-half of it would be enough." An inquest was had on the matter before Judge Shea, in Marine Court, this morning, and with interest allowed on the money due, the bill now amounts to $442.87, for which judgment was given.—*N. Y. Com. Advertiser, Jan. 2.*

Great Britain.

IMPERIAL CONTINENTAL GAS ASSOCIATION.—The half-yearly General Ordinary Meeting of Proprietors was held at the Terminus Hotel, Cannon street, London, on Tuesday, November 28, Julian Goldsmid, Esq., M.P., in the chair.

The Secretary (Mr. Albert F. Jackson) having read the notice convening the meeting, the chairman affixed the corporete seal to the register of proprietors. The secretary read the following report:

The present half yearly ordinary meeting of the shareholders has been convened agreeably to the company's Act of Parliament for the purpose of receiving a report from the president and directors upon the affairs of the association, and for declaring a dividend for the half year ended the 30th of June last.

Gas Made.—The total quantity of gas made at all the stations in the half year ended the 30th of June last was 2,477 million cubic feet. The total quantity made in the corresponding half year of 1875 was 2610 million, being a decrease of 133 million, or at the rate of 5·12 per cent. But as the diminution at Brussels and Bordeaux was 244 million, the remaining establishments show an increase of 111 million cubic feet.

Lights.—The total number of lights at all the stations on the 30th of June last was 1,111,399. The total number of lights on the 30th of June, 1875 was I,110,927, These figures show an increase of 472, or at the rate of 0·04 per cent. The lights at Bordeaux are included in both cases.

Mains.—The total length of mains laid up to the 30th of June last was 1148 miles. The total length of mains on the 30th of June, 1875, was 1196 miles, being a decrease of 48 miles,

The works and apparatus at the several cities and towns lighted by the association were, during the period now under review, in thorough repair and good working order, and sufficient for all requirements.

As heretofore, Mr. G. W. Drory has, with the assistance and co-operation of the engineers and agents at the several stations, ably superintended the conduct of the business, and of the affairs of the association on the Continent.

The rental for the half year ended the 30th of June last, 1876, was less than in the corresponding half year of 1875; but as there was during the period now under consideration a diminution at Bordeaux and Brussels, the rental at the remaining establishments really showed a fair increase.

The profit made in the half year now under consideration was larger than that for the corresponding half year of 1875.

The cost of the coal used in the half year now under review was 2s. 6d. per ton less than that of the coal used in the first half year of 1875.

Secondary Products.—The value of the secondary products—coke, tar, and ammonia—shows a satisfactory increase.

For the half year under consideration a large outlay has been incurred in the construction of new apparatus, and on necessary alterations in the premise, at Aix-la-Chapelle, Frankfort-on-the-Maine, Haarlem-Brussels, Berlin, and Vienna.

Additional mains of various sizes, and in quantities more or less considerable, have also, at a large outlay, been laid at Frankfort-on-the-Main, Hanover, Antwerp, and Vienna.

Expenditure on account of land was, during the half year ended the 30th of June last, incurred at the following stations, viz., Vienna, Lillie, and Hanover.

At Bordeaux the amount of the expert's valuation of the works, mains, and property of the association was paid by the "Societe Financiere" on the 1st of April last, and possession of the said works, etc., was given up by the association to the new Bordeaux Gas Company on the 17th of that month.

At Brussels, the balance alluded to in the last report as still due from the town authorities to the association under the award of the experts, not having been paid in accordance with the judgment delivered in the Court of First Instance, a citation calling upon those authorities to comply with that judgment was on the 13th of May last served upon them. To that citation they entered an appearance in court in the month of June last, and the matter remains for future settlement.

At Vienna, contracts were in the half year concluded with the suburbs of Hernals, Ober, and Unter-Döbling, Ottakring, Neulerchenfeld, and Nussdorf.

At the last half yearly general meeting a shareholder gave notice of his intention to propose at this meeting that the remuneration of the directors should be increased, which notice received the general approval of the shareholders, and will be considered at the present meeting.

In conclusion, the president and directors desire to draw the attention of the shareholders to the accounts for the half year ended the 30th of June last.

These have been duly audited, and from them the directors have, in accordance with the provisions of the Companies Clauses Consolidation Act, prepared a scheme showing the profits of the association for the last half year, and the portion thereof applicable to the purposes of dividend; which they recommend now to be declared—namely, a dividend of £2, and a bonus of 10s. per share, payable free of income tax, on and after the 15th of December next.—*Journal of Gas-Lighting.*

THE "MONOPOLY" QUESTION.—The London *Journal* makes the following remarks on the "Monopoly" question, and as they have both "Corporation" management and company management in England, they ought to know how the thing works:

We shall, in a future number, or numbers, give Dr. Farr's remarks on the value of the metropoiitan

gas and water undertakings, but we hope that many of our readers will peruse the entire paper in the journal we have mentioned. They will find much instruction and some amusement. One thing will, perhaps, strike them, and that is the fallacy running through Dr. Farr's argument, that when a gas or water undertaking passes into the hands of a local authority it ceases to be a monopoly. In one sense this is true, but in another the undertaking becomes the strictest of all monopolies. Consumers have some chance in successfully fighting a gas or water company, but they have none in struggling with a local authority. A corporation may laugh at all complaints, and continue to do just as they please. To day, for example, the local papers team with complaints of the quality of the gas supplied by the Corporation of Glasgow and Leeds. Whether or not they are well founded, of course, we do not know; but, supposing they are true, we know well that a gas company would very soon be compelled to remove the cause of complaint, while the large northern corporations may close their ears to all remonstrance. It is not, in fact, until an undertaking gets into the hands of a local authority that it becomes a real monopoly.—*Ibid.*

GAS EXPLOSION IN WESTMINSTER.—An explosion of gas took place on the night of Tuesday, the 28th Nov., on the premises of the Artisans, Laborers, and General Dwellings Company, Great George street, Westminster. Several of the windows were blown out, a portion of the house damaged by a fire which ensued, and the rest of the house and its contents by breakage. A servant was burned on her hands and face. the back windows of Sir John Hawkshaw's house adjoining were blown out, and the back windows on four floors of Mr. Spofforth's house, and of the two houses in Delahay street, occupied by Messrs. Gregory and Abernethy, civil engineers, were likewise destroyed, and the buildings and contents slightly damaged. The immediate cause of the explosion is not reported.—*Ibid.*

GAS EXPLOSION AT MARYHILL.—The *Glasgow Herald* states that on the night of the 27th Nov. while one of the Maryhill lamplighters was lighting a lamp near the aqueduct bridge, Main Street, the cover was shot off high up into the air, and a loud report followed. The lamplighter ran back, and observing that the gas was burning out at the post head, commenced to open the earth at the bottom to try and discover the escape. In another instant another loud report was heard, the light at the top head communicated with the gas at the bottom, and the result was that the earth and stones were violently scattered about. The lamplighter got his face scorched, and the back of his head was struck by some of the stones in their descent to the ground.—*Ibid.*

Gas Stocks.

Quotations by W. H. Scott & Co., Bankers,
24 PINE STREET, NEW YORK CITY.
JANUARY 16, 1877.

☞ All communications will receive particular attention

	Capital.	Par.	Bid.	Asked.
Gas. Co.'s of N. Y. City.				
Harlem	$1,850,000	50	105	110
Manhattan	4,000,000	50	—	240
Metropolitan	2,500,000	100	145	150
" Scrip	$1,000,000	...	100	103
" Bonds	500,000	1000	100	103
Mutual	5,000,000	100	95	97½
" Bonds, gold.	900,000	1000	105	—
New York	4,000,000	100	130	131
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	175	180
Citizens	1,200,000	20	95	—
" Scrip	320,000	1000	95	97½
Peoples	1,000,000	10	50	55
" Bonds	$ 325,000	...	---	95
" Scrip	300,000	...	85	--
Metropolitan	1,000,000	100	75	--
Nassau	1,000,000	25	75	80
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	135	140
" Scrip		...	98	100
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	—	80
" Bonds	200,000	1000	--	90
Baltimore, Md	2,000,000	100	150	170
" Ctfs., gold	1,000,000		105	—
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	95	97
" " Bds.	124,000	—	—	--
Derby of Conn	160,000	100	60	80
East Boston, Mass.		25	132	---
Fort Wayne, Ind		100	...	---
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	152	—
Hempstead, L	25,000	100	...	—
Jersey City	386,000	20	160	—
Jamaica, L. I	25,000	100	...	—
Jacksonville, Ill	120,000	50	82	...
Lewistown, Maine	400,000	100	50	85
Lima, Ohio	60,000	100	10	...
Bonds	30,000		90	
Laclede, St Louis Mo	1,200,000	100	100	110
Peoples, Jersey City		...	125	135
Leoples of Albany	650,000	100	—	20
" Bonds	350,000	1000	—	—
Peoples of Baltimore		25	99	100
" Bonds			106	—
Perth Amboy		25	—	95
Rochester, N. Y		100	50	60
Richmond Co., S. I.	300,000	...	97	100
Woonsocket, R. I	150,000	100	100	...
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	112½	
San Francisco Gas-Co., S. Fr'isco Cal.			99	100
St. Louis, Missouri	600,000	50	—	100
Stillwater, Minn	50,000	50	—	26
Suburban, W'stch'str	390,000	50	—	100
Saugerties, N. Y	15,000	100	110	115
Troy, Citizens	600,000	100	—	100
Central, Westchester	466,000	50		95

The Citizens of Brooklyn have declared and paid a dividend of 4 per cent.

The Laclede Gas Co., of St Louis, have declared a semi-annual dividend of 4 per cent., payable on demand.

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422 A1t Office AMERICAN GAS-LIGHT JOURNAL.

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These Works were established by the late John Neukumet, and are now in good running order. Immediate possession can be given.

All BIDS for the Purchase or Lease of the same must be in writing, and addressed to the undersigned, prior to the 15th of JANUARY, 1877.

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H. P. ALLEN, President.
I. B. BRICE, Vice-President.
A. H. ALLEN, Secretary.
WM. J. VALENTINE, Treasurer.
GEORGE W. HARRIS. Engineer.
This Company is the owner of the GWYNNE-HARRIS, or AMERICAN HYDROCARBON process, for making Gas for Lighting or Heating purposes, by the perfect decomposition of superheated steam, under what is known as the
GWYNNE AND HARRIS PATENTS.
This process has been fully tested nearly 50,000,000 cubic feet of Gas having been made under it, and fully demonstrating the fact that it is the greatest improvement ever made in the manufacture of Gas, either for Lighting or Heating purposes. With half a ton of Anthracite Coal 150,000 cubic feet of Gas per day is made from three benches, and the labor is so small that one man can attend three or four benches.
The process can be put into either Coal or Oil Gas Works (or where both Coal and Oil are used) at small cost, without any interruption to the working of other benches. The Citizens Gas-Light Company of Brooklyn, after using it for more than seven months, have found it not only far better, but actually *cheaper* than atmospheric air in making Gas, with the use of "petroleum and its products"
Further information, and terms of sale of rights will be given, upon application to the Company 348-1y

T. DEAN, Pres't. } {H. N. SMITH, Treas.
S. F. DEWEY, V. Pres. } OFFICE OF {CHAS. F. DEAN, Sec.
THE GAS-LIGHT CO. OF AMERICA
Nos. 63 and 64 Drexel Building,
P. O. Box, 5131. NEW YORK.
THE GAS-LIGHT COMPANY OF AMERICA, owners of the Patent Processes for making ILLUMINATING GAS from PETROLEUM and its products, known as the
Gale and Rand
AND
Wren and Barker Patents,
are prepared to treat with Gas Companies and Manufacturers of Gas for the use of said processes.
An examination of the merits of these inventions as demonstrated by practical experience in a large number of Gas Works employing them, will not fail to convince the intelligent Gas Manufacturer of the great advantages derived from their use.
Gas of unexceptional quality, of high illuminating power is made at many of these works by these processes, at a cost of from 40 per cent. to 60 per cent. less than an ordinary quality of illuminating gas can be made by any other methods in use. Gas Companies generally may easily, and at small outlay for making the necessary changes in manufacturing apparatus, double their net earnings, and supply a much better light to their patrons, at greatly reduced prices.
The Company respectfully refer to Companies using these processes in this city, Reading, Penn., Chicago and elsewhere, and especially to the Mutual Gas-Light Company of Detroit Mich., whose works more nearly conform in all details of construction to the original plans of the inventors, than those of other Companies.
For Correspondence, etc., address to office as above.
CHARLES F. DEAN, Secretary.

NATIONAL FOUNDRY
AND PIPE WORKS.
OFFICE AND WORKS—CARROLL, PIKE, SMALLMAN AND WILKINS STREETS,
PITTSBURGH, PA
WM. SMITH,
Manufacturer of all kinds of GAS and WATER PIPE BRANCHES, CONNECTIONS, T's, ELBOWS, and all CASTINGS USED AT GAS AND WATER WORKS,
We offer special inducements to parties wishing to purchase. My Pipe is Smooth, regular in weights, and cast vertically.
N. B.—Pipe from 3 inch and upwards, cast in 12-ft. lengths.
☞ SEND FOR CIRCULAR AND PRICE LIST.

S. DECATUR SMITH,

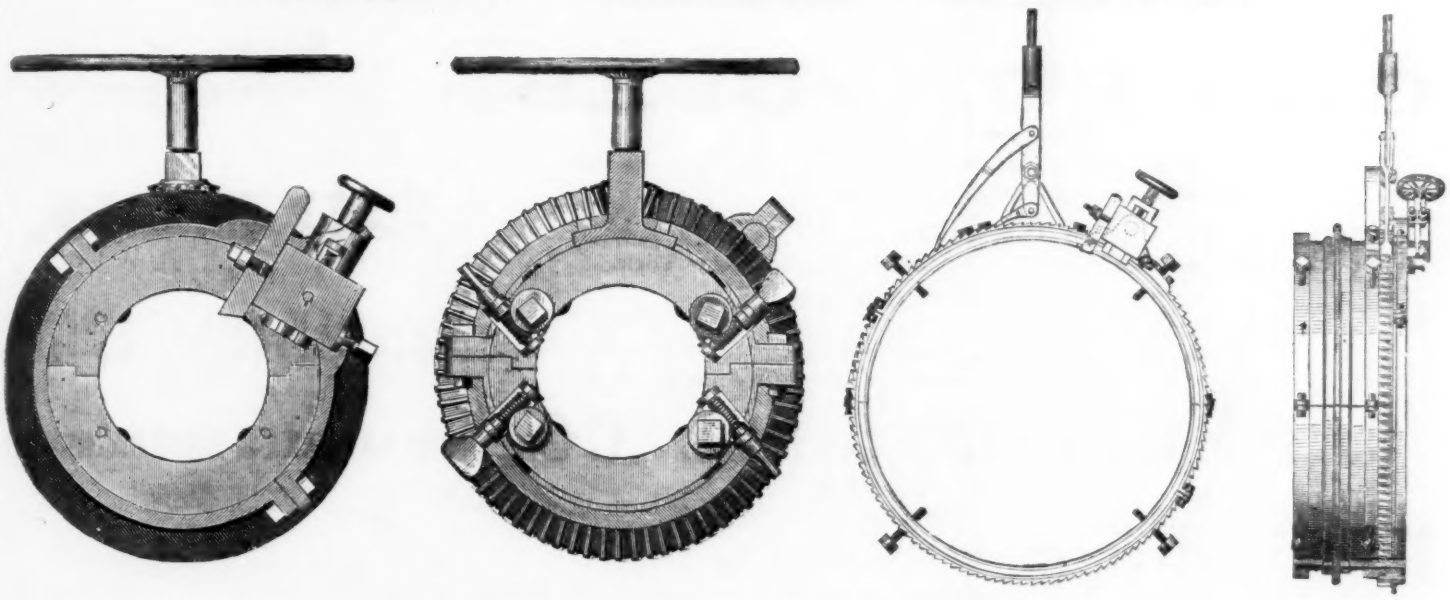
CAST IRON GAS and WATER PIPE,
Foundry, Cor. of York and Moyer Streets,
PHILADELPHIA.
Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.
☞ FITTINGS FOR GAS AND WATER MAINS.

A. C. WOOD'S PIPE CUTTER.

PATENTED MAY 23rd, 1876.

THIS IS THE ONLY HAND MACHINE IN THE WORLD FOR CUTTING

CAST IRON PIPE.



It will cut Cast or Wrought Iron Pipe, Shafts, or Columns of any size, making a clean, smooth, and square cut.

A Continuous Line of Pipe in a Trench or Building

cut, as well as Loose Pipe.
Our Machines for cutting 30-INCH PIPE have been furnished to the Manhattan and New York Gas Light Companies, and operate to their entire satisfaction.
The smaller sized Machines have been in practical use for more than a year, with the most satisfactory results. For further information address

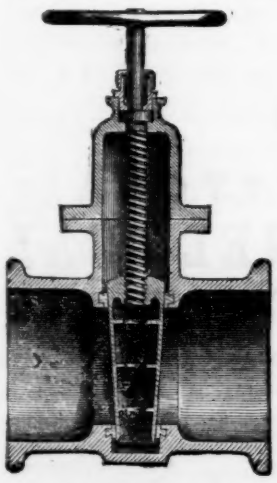
A. C. WOOD, Syracuse, N. Y.
Or Messrs. HERRING & FLOYD, No. 744 Greenwich Street, N. Y.

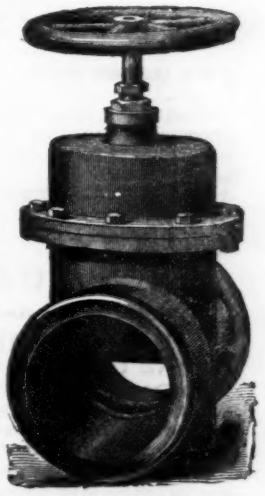
CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

CHAPMAN GAS VALVES.

Office and Sales Room 75 and 77 Kilby Street, Boston.





These Valves have been in use for several years, and are pronounced by all who have used them to be

The Best Gas Valves Ever Made.

They afford a direct passage the full size of the pipe. The seats are made of an alloy similar to BABBITT metal, specially prepared for the purpose, and superior to all other metals used for the seats of Gas Valves. It does not corrode under any circumstances to which it is exposed.

There is no LIABILITY OF COHESION between the Gate and Seat, and the Valves can be relied upon to SHUT TIGHT and OPEN EASILY at all times—an important desideratum when used for street mains, in cases of fire.

We refer to the following named Gas-Light Companies among the many that have used these Valves:

BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CAMBRIDGE GAS-LIGHT COMPANY, CAMBRIDGE, MASS.
NEWTON & WATERTOWN GAS-LIGHT CO., WATERTOWN, MASS.
LAWRENCE GAS-LIGHT COMPANY, LAWRENCE, MASS.
PEOPLES GAS-LIGHT COMPANY, BROOKLYN, N. Y.
CITIZENS GAS-LIGHT COMPANY, BROOKLYN, N. Y.
SOUTH BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CHARLESTOWN GAS-LIGHT CO., CHARLESTOWN, MASS.
LYNN GAS-LIGHT COMPANY, LYNN, MASS.
FITCHBURG GAS-LIGHT COMPANY, FITCHBURG, MASS.
CITIZENS GAS-LIGHT COMPANY, NEWARK, N. J.
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GAS AND WATER VALVES ½ INCH TO 36 INCHES DIAMETER.
STEAM VALVES ½ INCH TO 12 INCHES DIAMETER.

357-tf

GAS COALS.

THE
PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station, on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

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PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

CANNELTON COAL CO.

OF WEST VIRGINIA.

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County, West Virginia, delivered at RICHMOND, Va.:

CANNELTON CANNEL,

acknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding **10,000** ubic feet of GAS of **64·54** CANDLE POWER; COKE **32** bushels, of good quality.

CANNELTON CAKING COAL.

Volatile Matter.	Coke.	Per cent. of Ash in Coal.	Per cent. of Ash in Coke.	Sulphur in Coke.	Sulphur in Oötl.	Sulphur in Volatile Matter.	Specif. Gravity. Coal.	Specif. Gravity. Gas.
35.1	64.9	2	6	.82	1.48	.66	1,289	.476

MAXIMUM YIELD, **5.06** cubic feet of Gas per pound of Coal—A yield of **4·78** cubic feet per lb.. —gave **16 14-100** Candle-Power.

COKE, of very fine quality—**1453** pounds produced from one ton of coal.

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TO GAS COMPANIES.

FOR SALE, IN LOTS TO SUIT.

TWO HOLDERS—one with Iron Columns and Girders.

HYDRAULIC (4 inch) STAND PIPES, MOUTH PIECES and Covers for two benches of Threes.

Three IRON RETORTS—Condensers, Washer and Washer Tank.

Three Round (4 feet) PURIFIERS and Covers, with Center Seal and connections Station Meter and several Dry Meters

Apply at the office of this Journal. 412

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Corner of Jay and Water Streets,

BROOKLYN, N. Y.

HAVING GRANTED THE USE OF ONE OF my Patents to the Gas-Light Company of America, and settled my claim against them, I inform the profession that I continue to erect Works and sell Licenses to use my Patents for making Gas from Petroleum.

You can enrich your Coal Gas to any desired standard, by using my process, in the simplest manner, and much cheaper than by *any other* method.

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GEORGE H. MORRISON,

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Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.

Company's Office, No. 52 S. Gay Street, Baltimore, Md.

C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.

CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

SINCLAIR & AGNEW, Agents, Alexandria, Va.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

234-1y n

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies throughout the country.

Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y.

BANGS & HORTON, No. 31 Duane street, Boston.

Mines in Harrison County, West Virginia.

Wharves Locust Point, Company's Office, 15 German St., } Baltimore.

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine

*** Reference to them is requested. 204-

GENERAL COAL AGENCY

OF THE

Chesapeake and Ohio Railroad Co.

For the Sale and Distribution of the Superior

Cannel,
Splint,
Gas and
Steam

COALS,

FROM THE

Kanawha & New River Coal Regions

ON THE LINE OF THE

CHESAPEAKE & OHIO RAILROAD,

IN WEST VIRGINIA.

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A. S. HATCH, General Manager, C. & O. R. R. Coal Agency, 5 Nassau St., N. Y.

426-6t

NEW YORK AND CLEVELAND

GAS COAL COM'Y

Of Pittsburgh, Pa.

MINERS AND SHIPPERS OF

YOUGHIOGHENY GAS COAL.

This Company is prepared to furnish any amount of their justly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation, on most favorable terms.

General Office—384 Penn Avenue,
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Branch Office—C. & P. RR. Coal Pier,
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WILLIAM A. McINTOSH, President.
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W. P. DE ARMIT, Treasurer.
THOMAS AXWORTHY, Agent at Cleveland, Ohio.

351-1y

PEYTONA

CANNEL COAL

From West Virginia.

Yields over **13,000** feet of Gas per ton. At ten thousand feet (standard yield) the illuminating power is over **43** candles. Purifies **4,510** feet to the bushel of lime.

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B. E. CHOLLAR,

GAS ENGINEER,

914 OLIVE STREET, ST. LOUIS, MO.

385-

IMPROVED GAS EXHAUSTER,

WITH ENGINE ATTACHED ON SAME BED PLATE.

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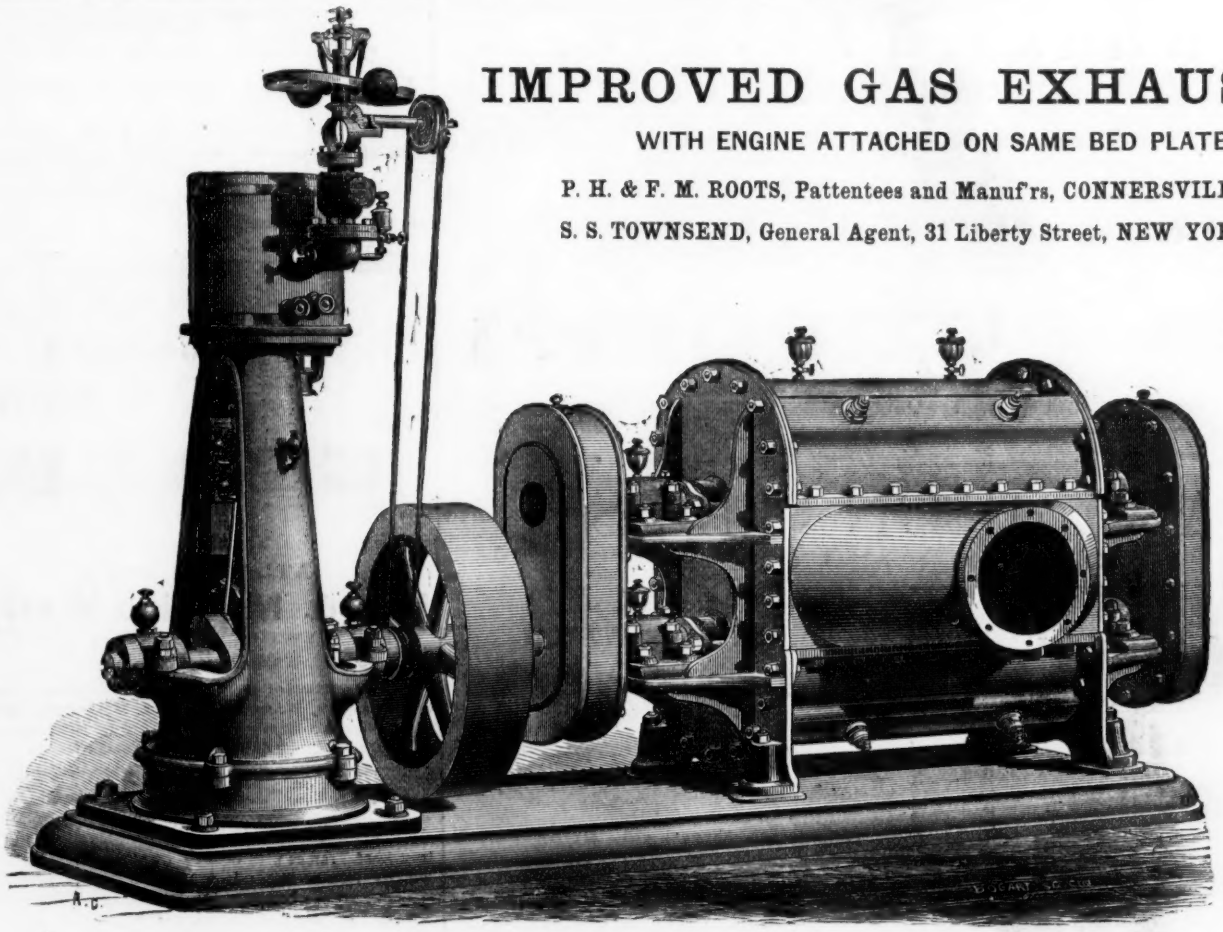
S. S. TOWNSEND, General Agent, 31 Liberty Street, NEW YORK.



ADVANTAGES CLAIMED FOR THIS EXHAUSTER.

1. It is simpler than any other Exhauster. The internal operating parts consist of only two pieces, cast entire, and can not get out of order.
2. Every part requiring care or attention, is external and easily accessible. All changes, adjustments, and repairs are made from the outside.
3. The revolvers, though practically gas-tight, do not run in actual contact, hence there is no friction, and a great saving of power effected.
4. They are built in the most complete and substantial manner, and of any required size, with steel shafts and improved journal bearings.
5. We furnish Exhausters and Engines combined on same Bed Plate, as shown above, or the Exhauster only, as may be required.
6. We also furnish Bye Passes and Gas Valves on improved plans, also Exhauster Governors and Elbows, Pipes, Drawings, etc.

Send for Illustrated Catalogue, giving details of capacity, speed, power required, price, and references to parties using them.

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THE WAVERLY COAL AND COKE CO.

Offer for Sale the

YOUGHIOGHENY COAL

DOUBLE SCREENED,

from their Colliery at Smith's Mills, on the Youghiogheny River, thirty-seven and a half miles southerly of Pittsburgh. This Coal has the preference in Pittsburgh over all other YOUGHIOGHENY COAL for GAS PURPOSES.

The facilities of the WAVERLY COMPANY are unsurpassed by those of any other Company on the Youghiogheny.

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MANUFACTURERS OF

Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,

ALWAYS ON HAND.

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IMPORTERS OF

LAVA TIPS AND SCOTCH TIPS.

ALL ORDERS DELIVERED FREE TO NEW YORK.

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Gas Engineers,

AND PARTIES ENGAGED IN THE BUILDING OF

GAS WORKS,

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SPRINGFIELD GAS MACHINE
238 CANAL ST.
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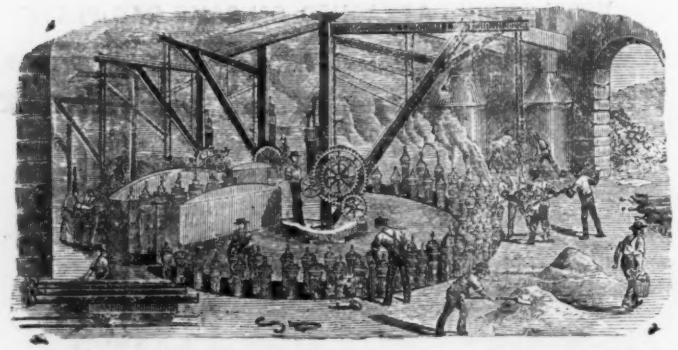
M'NEALS & ARCHER,

BURLINGTON. N. J,

Flange-Pipes



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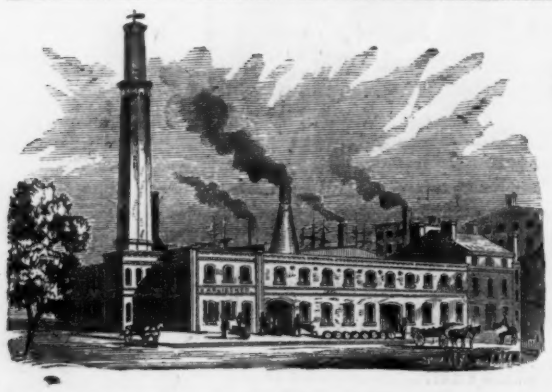
CAST IRON PIPES

FOR WATER AND GAS.



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Retort Works.

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(Branch works at Kreischerville, Staten Island.)

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OFFICE,

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GAS RETORTS, TILES & FIRE BRICK
Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

Articles of every description made to order at th s hortest notice.

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Clay Cas Retorts
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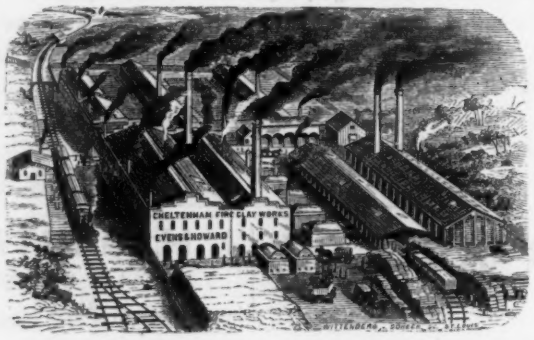

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Ground Fire
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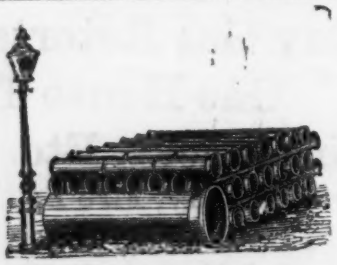

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Lamp Posts, Valves, Etc.

Mathew's Pat. Anti-Freezing Hydrants,

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Roman Cement,

Keene's White Cement,

English Fire Brick, No. 1, $35 per M.

" Silica Fire Brick, $60 "

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☞ Remit 10 cents postage for "Practical Treatise on Cement."

KIDD'S

Gas Consumers' Guide

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It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to the registration of their meters. For sale by

A. M. CALLENDER & Co.,
42 Pine Street, New York, Room 18,

JOHN P. KENNEDY,

SUCCESSOR TO

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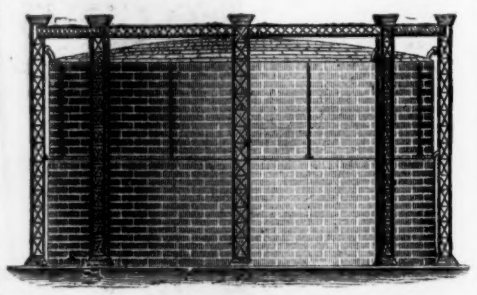
GAS ENGINEER AND CONTRACTOR

For the Erection, Alteration and Extension of Gas Works.

PLANS, SPECIFICATIONS AND ESTIMATES.

Office 111 Liberty Street. P. O. Box 2,348



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Iron & Machine Works,

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MANUFACTURERS of every kind of Gas Machinery, Retorts Bench Castings, Wrought Iron Work, Multitubular and A Condensers, Washers, Scrubbers, Purifiers, Exhausters with every equipment complete for large or small Works,

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Iron Roof Frames with Cornice Gutters, covered with Corrugated Iron or Slate; Iron Doors and Iron Pivot Blind Windows; Coke Barrows, Fire Tools, Retort Lids, Cotter Bars and Screws, Stop Valves, Tar Valves for Regulating Dip in Hydraulic Mains, Pressure Governors for Street Mains, and Compensators for Exhausters that are unrivalled for unvarying accuracy Steam Engines, Boilers, Etc. Etc.

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NEW IRON COMPOSITION

Has purified, per bushel, on a single test, 10,000 feet of Westmoreland Gas. With revivification lasts indefinitely. Surpasses in POWER and ECONOMY all known materials. Saves largely in FIRST COST, SPACE, LABOR, SUPERINTENDENCE, and all current expenses. Will purify *easily* sulphurous gas, wholly *unmanageable by lime.* Takes out *all the ammonia.* Now operating in the following Gas Works: Harlem; New York (21st street); Port Morris; Hunter's Point; East New York Worcester, Lynn and Cambridge, Mass.; Lewiston, Maine; St, Albans, Vt.; Pawtucket, R. I.; Meriden, Ct., and being introduced in many other places.

Cost 70 cents per bushel. One bushel for each square foot of Purifier sufficient. Rights to use for life of Patents, for daily makes of gas in thousands; under 25,000 $200; under 50,000, $400; under 100,000, $500 $250 additional for each additional 50,000 per day.

For further information and instructions, apply to

ST. JOHN & CARTWRIGHT,
21st Street and Avenue A, New York Gas Works.

☞ Immediate arrangements are urged, as the demand for the prepared composition is increasing *so rapidly* that delays in supply may occur.

GEO. STACEY. HENRY RANSHAW WM. STACEY

GEO. STACEY & CO.,

MANUFACTURERS OF SINGLE AND TELESCOPIC

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Cast and Wrought Iron Work

Used in the Erection of Gas and Coal Oil Works.

Foundry on MILL STREET; Nos. 33, 35, 37 and 39.

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REFERENCE.

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Springfield, O., Gas Co.	Quincy, Ill., Gas Co.
Terre Haute, Ind., Gas Co.	Champaign, Ills., Gas Co.
Madison, Ind., Gas Co.	Carlinville, Ill., Gas Co.
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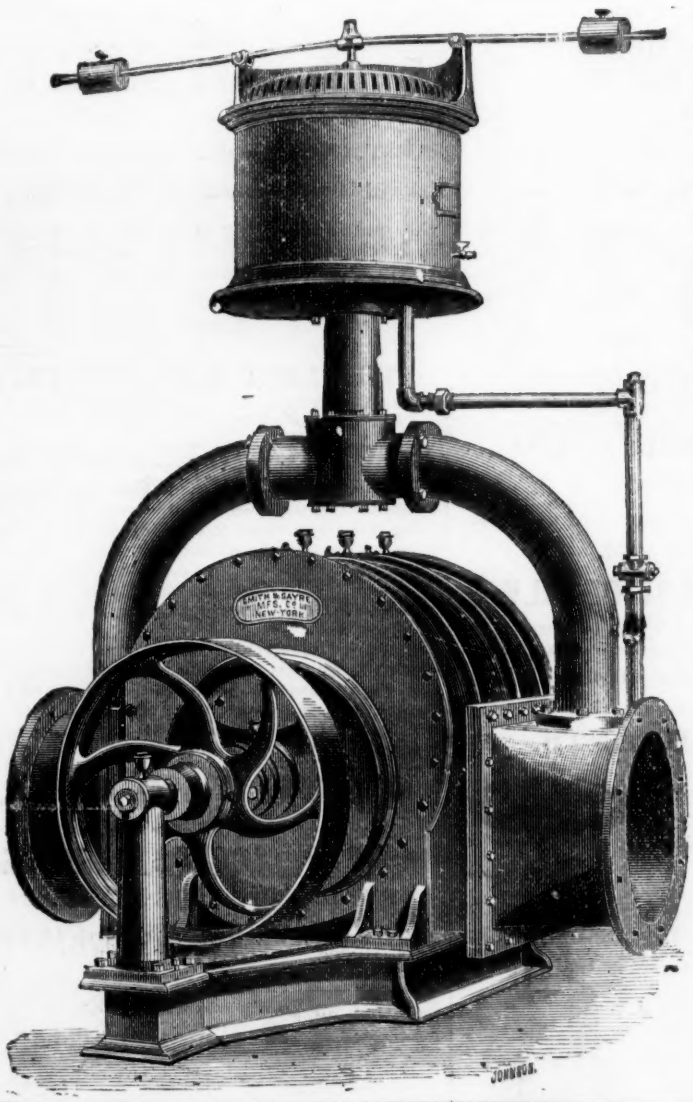
R. T. Coverdale, Eng'r Cincinnati, and others.

SMITH & SAYRE MANUFACTURING COMPANY.

The Mackenzie Patent Gas Exhauster

And Patent Compensator.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-jo ints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

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The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary fan The Cupolas are manufactured in sizes to melt from 1 to 20 tons per hour, will save one quarter of the time required by the old style Cupola and 33 per cent fuel. Address

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Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gas Holders, &c.

Office No. 6 North Seventh Street, Philadelphia.

T. F. ROWLAND,

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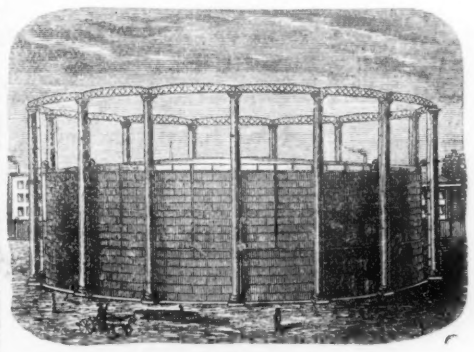
GREENPOINT, BROOKLYN, N. Y.

ENGINEER AND MANUFACTURER OF



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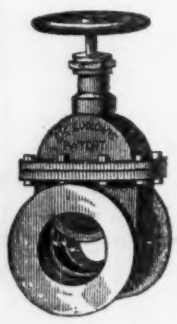

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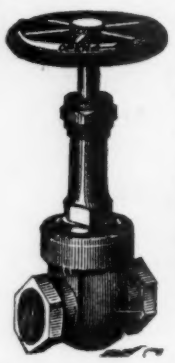

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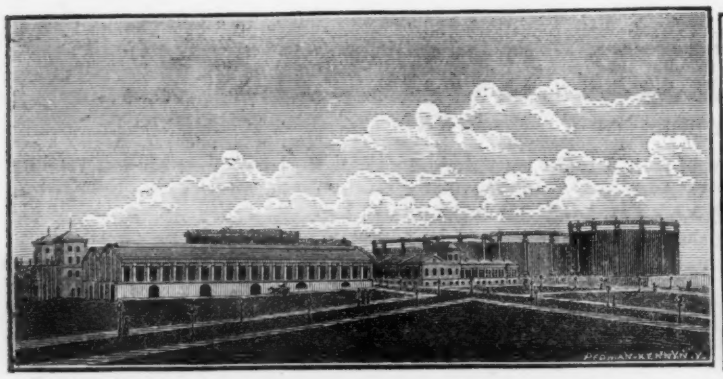

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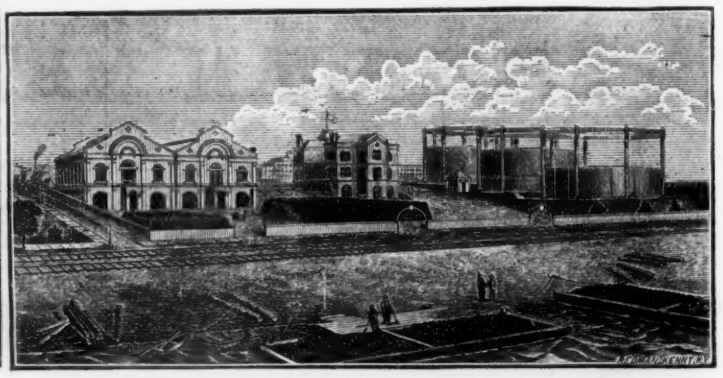

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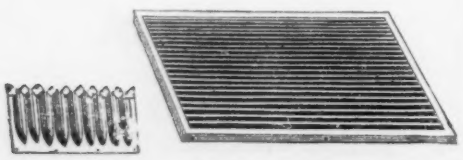

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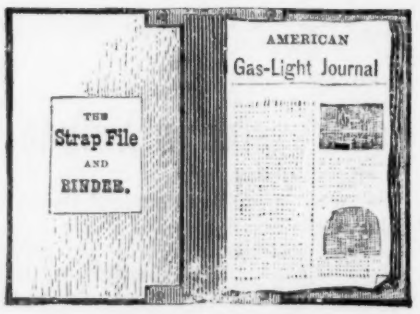

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